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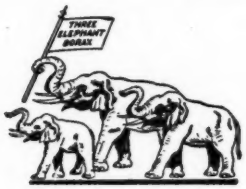

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Better Crops with PLANT FOOD

The Whole Truth—Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington 6, D. C.

VOLUME XXIX NO. 1

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WINTER BRINGS WITH IT EXTRA CHORES

Better Crops with PLANT FOOD

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VOL. XXIX WASHINGTON, D. C., JANUARY, 1945 No. 1

Past and Present . . .

Renunciation

Jeff McDermid

JANUARY is the Time for Reform. Renunciation and self-abnegation have caught up with me again! I am once more in the throes of humiliation and ready for high resolves. From time immemorial, or ever since I can remember anyhow, New Year's was noted as a milestone at which to stop and renounce something. I will not bore you with the things I have vowed to renounce and relinquish, but I have found at long last a keen way to accomplish my self-torture with less likelihood of being accused of backsliding. *My simple secret is one which you can use with equal celerity. New Year's is a dandy time to renounce something when it's something you can't get!*

Taking out my list of possible taboos, I might first resolve to quit tempestuous liquors—but I seldom find a person with a free-treating habit these days; which means that the breaking of such a pledge would be so expensive that a sane Scotchman would never mock his deprivation so wantonly.

Next in the roll of vices to vanquish is the nasty old smoking habit. Here is where my new patent recipe for renunciation comes in handy for 1945. For experience recently tells me that the brands of cigars, cigarettes, and pipe tobacco now available on short notice from my corner smoke-shop make an undiluted combination of materials which are far easier to quit than to continue.

So we have herein to be thankful for scarcity, which now breeds sanctity. This means of reforming is by no whit new, but it is far easier on the ego and the peace of mind (and your family) than the old-fashioned method of keeping the awful temptation constantly in

view of the victim. While I cannot exactly say that this new rule envisages the theory of "out of sight, out of mind," it surely has some advantages over the system I once invoked so lamentably on former spurts of temporary reform. But in those days, there was always a surplus of the sinful things staring me in the face. I had to wrestle with myself alone, not the whole industry responsible for my weakness. Now that the industry itself has gone back on me, now that the supply is curtailed, I merely turn my thoughts to handy substitutes, like essay writing.

AT this juncture some of my ardent fans may cast doubt on my ability to hit it up on high minus the comforting and solacing stimuli administered copiously in bottles and packets—and in solemn truth I share their solicitude.

Yet, as I said previously, some things are easier to refrain from than to relish, to wit: placed before me as I type are four alleged cigarette assemblies, entitled respectively, Delhi, Fumiglue, Smudglets, and Turpentines. On my table are two Mahatma Gandhis that sell for 30 cents each and have a sneaking resemblance when ignited to those good old Wheeling stogies we used to get sick on thirty years ago. A kind neighbor dropped in and donated a Missouri corncob pipe and a yellow bag of Standard of the first rank. Now I am safe and secure from temptation and enjoy mellow thoughts of the manner in which my original favorite smokes are being used to keep up the watch on the Rhine.

Thus armored against surrender, I relax and conjure up anecdotes of boyhood, when first I learned to puff the weed.

We got the idea of using cigarettes from an older brother who came home on summer vacations. He would loll in the faded hammock and indulge in his vice with nonchalance. The little white bag with the yellow draw string and gaudy bull picture on the label, the tiny leaves of rice paper, the deft finger-work, then the quick lick and the twisted end, finally the lighted match, and away he went!

The only brand of ready-made cigarettes sold in our section was Sweet Caporals, bearing the red cap trademark. I never had money to buy any and haven't seen a packet for years.

You couldn't stand a cigarette made from the kind of pipe tobacco the menfolks used in our neighborhood. It was too stemmy and hard to wrap anyhow, and blistered the tongue off a wagon. The only other manufactured leaf to be had was fine-cut, a popular "Tiger" brand of eating tobacco much favored by my father and other veterans used to hardships and small pleasures.

He kept his round, flat, five-pound tins of this juicy tidbit on a shelf in the cellarway. I used to lift the lid on the sly and borrow some of the stringy fibrous stuff, and I began chewing on this mixture before I ever tried to smoke it. Once I reached for it and missed, and pulled the whole outfit off the shelf and scattered it down the stairs. This scared me so that we abandoned home pilfering parties, and instead we tapped the stocks in reserve at the janitor's shop in the high school. However this material was hard to deal with, as it was made like Civil War hardtack in big oblong plugs, redolent of molasses, and as tough to cut as a hickory stick. Sometimes we found some twisted ropes of flavored leaf, which looked something like crullers without the grease and tasted like an abandoned bird's nest.

BUT all this was risky and unsatisfactory for smoking in the burrowed dirt cave den we liked to hide away in as kids. Here we kept our Diamond Dicks, Western Wild Life, King Brady, and the Liberty Boys of '76 series, all sticky and damp with mold, but mighty magical for a sub-rosa spell of urchin camaraderie.

These retreats were out in the meadow handy to the main source of cigarette substitutes. The plant we used was the well-known mullen. As

the summer advanced, its lower circle of leaves got brown and crusty. These we picked and crumbled up. Newspapers furnished our wrappers. Wet mouthings usually made a soggy mess hard to light and floppy on the draw, so we swallowed more mullen than we whiffed. Our secondary substitute was

corn silk. Its only claim to perfection in perfectos was a sort of faint resemblance to fine-cut, while the smoke was sweetish and flat.

When officials report that 329 billions of cigarettes were manufactured in 1944, of which 90 billions were reserved for the armed forces, it surely emphasizes the change in tobacco customs since the days I have been telling about.

I often think that whiskers and chewing tobacco went together as naturally as smooth faces and cigarettes do today. Anyhow all my uncles as well as Dad and his cronies carried their leaf inside their cheeks in bulging pouches, dreening away the residue by gravity into their noble hirsute adornments. Whiskers hid some of the smart color effects except when a guy got old and had long white alfalfa, whereupon the streaks trickled down in weird patterns.

You who are addicts to smoking accoutrements may tell Friend Wife for me that she has no kick coming about a few ashes on the rug or an upset baccy box. If she had been married half a century sooner, her woes would have been much multiplied by virtue of the masticating habits of the male—which did not cease when he finished his pie. It was just beginning, for his next move would be to go into the parlor and snag off a wad of Climax or Battle Ax, reach for the tin spittoon, and sigh with relaxed content.

Give her a roomful of argumentative menfolks waiting for election returns with one spittoon between them, and all the charwomen in New York would be kept busy mopping up those overshots. And moreover, to be explicit about it, once a day or oftener some member of the family was penalized for misconduct and sentenced to the job of swabbing out the cuspidors.

I haven't had a spittoon in my house since I was married. Quitting the chaw habit is not the main reason why. I'll give you one guess at it.

But I see they still keep cuspidors in every regulation hotel room, besides the ash receivers. I presume they cater to all tastes and don't mind a little overhead to keep things clean underfoot. Yet guests who chaw their leaf these days are as rare as the ones who smoke cigarettes! Again I say, the ever-ready, clean-shave outfits have much to do with the per capita decline in juice production.

TO some menfolks it's painful to suffer direct customer competition from the women and girls in matters of smoking. Especially in a tight situation like this I hear renewed regrets that women risk their health and breath on such vile concoctions, or crowd their way into some ill-smelling rest-room to fumigate with fags. They complain that this endangers the next generaiton and makes the present female line brazen and debauched. In fact, it's the same kind of arguments Dad and his buddies used in opposing women suffrage in the nineties. Only it carries no more weight than a flea, and is about as sane as trying to stop the war with a prayer.

On the contrary, I like to have good company in whatever business I engage. It gives me more independence and

(*Turn to page* 49)

Fertilized Corn Plants Require Well-ventilated Soils

By G. N. Hoffer

Lafayette, Indiana

UNLIKE rice, cranberries, weeping willows, cypress, and other water-loving plants in general, corn plants grow best in well-drained and aerated soils. They cannot endure wet soils for any length of time and cannot get along without plenty of oxygen for their hard-working root systems. Few of us realize the amount of work which the roots of corn plants carry on. They must anchor the plants firmly and must absorb mineral nutrients in abundant amounts to support the demands of the above-ground, sun-lighted parts of the plants. They are the living parts of the corn plant which we frequently overlook when we try to diagnose foliage-deficiency symptoms or become dissatisfied with the size and quality of the ears produced.

The root cells contain living protoplasm which must be nourished with foods delivered to them from the green parts of the plants. The root cells breathe and need ample supplies of oxygen for their respiration. They give off carbon dioxide as a by-product which if it accumulates and dilutes the oxygen supply in the air spaces around the roots becomes harmful. Hence it is important to have the root zones well ventilated, i.e., ample oxygen for the breathing roots and the continued oxidation of plant nutrients, and to provide escape avenues for accumulated carbon dioxide and other gases generated in soils when organic matter decomposes.

Many fields of corn in the Midwestern States during the past season were fertilized by placing large amounts of fertilizers into the plow furrows when the fields were plowed. Frequently large amounts of organic debris of former crops were also turned under. The fertilizers used were mostly those containing high percentages of nitrogen, such as 8-8-8 and 10-6-4, and were applied at rates from 800 to 1,200 pounds per acre. In addition, the plants were fertilized in the row with starter fertilizers of various grades and rates.

Excellent results were obtained in practically all cases where the soils were found to be well-drained and in good tilth, and where the stands of corn and the rainfall were ample. Increased yields of from 15 to 85 bushels of corn were harvested. When the applied fertilizers produce these profitable increased yields, much satisfaction to the growers results.

Negative Results Studied

However, during the latter part of the 1944 growing season numerous cases of "negative" responses to the plow-furrow fertilizers were reported. The heavily fertilized plants were no better than the plants fertilized in the regular manner with row applications. Some of the growers were ready to condemn this plow-under method of using fertilizers because it did not work in their fields. It became quite important to discover whether the method was at fault or whether the grower was at fault in using the method in fields unsuited for it.

It has been the opportunity of the writer to study a number of these so-called "negative-response" fields in several states. In all cases the situations found were very much the same. By going underground and noting the

roots of the non-responsive plants and by splitting open lengthwise the affected corn plants, the story of root suffocation and poisoning of the joint tissues unfolded. The disintegrated joint tissues in the base of the plants showed why many of the dependent roots were starved in addition.

Briefly, the diagnosis of these troubles seemed to be as follows: when large quantities of organic matter and nitrogen-carrying fertilizers are plowed into the soil, enormous amounts of nutrient and energy materials are available for the corn plant roots and the soil organisms, mostly bacteria and fungi, to feed upon. These stimulated activities create a large demand for oxygen for both the growing corn roots and these other soil inhabitants. In well-drained soils in good tilth and aeration capacity, the oxygen of the air and that carried into the soil in rain is adequate for all the living entities involved as in Figure 6. When the supply of oxygen in the soil air and water becomes insufficient for the living corn roots and microorganisms, an oxygen tension is created under which the corn roots cannot compete with the soil bacteria and fungi, Figure 5. The corn roots need free oxygen while the bacteria in manifold reduction processes can extract it from numerous oxygen compounds in the soil as well as those in the applied fertilizers.

Such conditions occur mostly in heavy-textured soils, either because of poor drainage facilities or because the tilth or porosity of the soils has deteriorated due to a depletion of the original organic matter. In some of the fields the penetration of oxygen is adequate only three to four inches below the surface, or maybe to the plow sole, and the roots of the corn plants remain healthy to these depths. When the oxygen deficiency occurs in this six- to eight-inch zone, the consequences are serious to the corn roots, as shown in Figure 5. The roots closer to the surface may survive but the deeper ones succumb to suffocation and/or poisoning from the reduced compounds produced by the bacteria, technically known as anaerobes, when competing for oxygen under these conditions. Some varieties of corn plants respond to these conditions of oxygen deficiency by producing "brace-roots" from joints above the surface of the soil. These roots are stimulated into growth not so much by the swaying of the corn plants as by defections of the lowermost joint tissues in the bases of the stalks. The brace-roots grow into the upper layers of the soil and function in these aerated parts.

Diagnosis Relatively Simple

The diagnosis of these aeration-deficiency troubles is relatively simple. In most Midwestern soils there are large quantities of iron compounds which are very responsive to the conditions created by oxygen tensions in the soil. When the demand for oxygen for the rapid decomposition of organic matter takes place under the usual warm soil conditions in summertime and the supply of oxygen in the soil air and moisture is insufficient, the ferric-iron compounds will give up some of their oxygen to the organisms and ferrous-iron compounds are formed. The relative extent of the reduction of ferric iron to ferrous iron at different levels in the soil profile must be detected within a few seconds in the field when the soils under these conditions are studied. By means of simple chemical tests described later, the depth of oxygen penetration into the soils can be noted by determining how deep ferric iron is present in the soil.

Corn roots thrive in the soil layers when the tests show most of the iron in the ferric condition. When the tests for ferric iron become less and the amounts of ferrous iron increase, the roots are damaged either by suffocation or by deleterious materials such as nitrites, sulphites, sulphides, and unoxidized organic acids gener-

ated under these conditions of oxygen deficiency. Some of the nonresponsive corn plants in fields with plowed-under organic matter and fertilizers had living functioning roots only in the upper three to four inches. The tests for ferric iron were positive only in these upper parts of the soil profile.

In responsive corn fields the soil tests showed ferric iron in abundance to 20- and 30-inch depths. Accordingly, it was apparent in a most striking way that corn roots are very sensitive to the oxygen deficiencies, as indicated by these ferric and ferrous iron tests. When conditions in the soil, such as occur with temporary waterlogging, poor porosity, compaction from plowing the soil too wet, and slow drainage, favor even temporary anaerobic decomposition of the organic matter to the extent that ferric iron and other compounds lose their oxygen, corn roots in these oxygen-deficient zones are damaged severely and cannot function normally in absorbing nutrient materials.

These aeration diagnoses can be made at any time during the growing season. By making quick soil tests for ferric and ferrous iron in the field from freshly exposed soil and observing the state of health of the corn roots under these various conditions during the growing season, it becomes very obvious why corn roots can utilize fertilizer materials only when they are supplied with oxygen, either from the soil air or rain water, at a level sufficiently high to keep most of the iron compounds in a ferric state. They must remain absolutely healthy when in competition with all of the other soil inhabitants for plant nutrients. When the competitive conditions favor the corn plants, they can then absorb the plant nutrients in sufficient amounts to produce high yields of good quality corn. It is true also that under these soil conditions of good aeration the fertilizing materials remain in the best form for absorption by the roots.

It is hoped that these observational and simple chemical test diagnoses will direct the attention of research students in soil fertility to these aeration problems connected with the deep placement of fertilizers for corn and other crops. If any conclusions can be drawn from the above report, they would be that to grow corn successfully in seasons with adequate rainfall the soil must be in good physical condition to supply oxygen adequately to the functioning root system in competition with all of the other environing factors. If the soil does not have good ventilation, it may be necessary (a) to fertilize deeper rooting legumes, such as alfalfa and sweet clover, (b) to use drain tiles and/or establish drainage ditches, and (c) to practice deeper tillage if a plow sole or hard-pan has developed in the field. Keep in mind always that corn roots breathe and require oxygen to perform their all-important task of absorbing mineral nutrients from the soil.

Chemicals and Technique Used in Diagnosing Oxygen Deficiencies in Soils for Corn Plants

Obtain a supply of 3-inch filter papers and prepare three test solutions, A, B, and C, as follows:

Solution A.—Hydrochloric acid (HCl). Dilute concentrated CP acid, one part acid to 4 parts distilled water by volume.

Solution B.—Potassium thiocyanate (KCNS). Dissolve 10 grams potassium thiocyanate in 100 ml distilled water.

Solution C.—Potassium ferricyanide. ($K_3Fe(CN)_6$). Dissolve 0.5 gram in 100 ml distilled water.

Place all three solutions in separate bottles with droppers. They must be ready for quick service.

Tests for Ferric and Ferrous Iron

The soil tests for ferric and ferrous iron must be made within 20 or 30 seconds on samples from freshly exposed soil surfaces. With a spade dig

CHEMICAL TESTS FOR FERRIC AND FERROUS IRON

IN SOILS

Fig. 1. Place soil samples on crease at (a) and (b). Add two drops acid-A to soils and fold paper tightly.

Fig. 2. To wet areas apply one drop Sol. B to (a), and one drop Sol. C to (b).

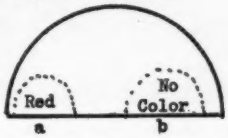


Fig. 3. Red color (a) indicates Ferric iron.
GOOD AERATION.

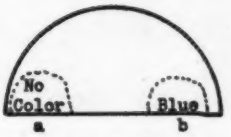


Fig. 4. Faint red or no color at (a) and blue color at (b) indicates Ferrous iron
POOR AERATION

INTERPRETATION OF SOIL TESTS

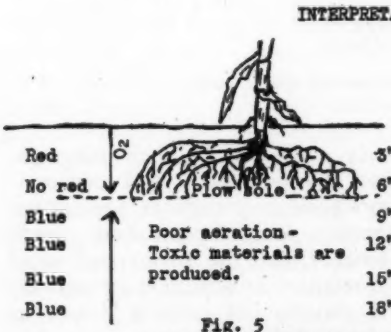


Fig. 5

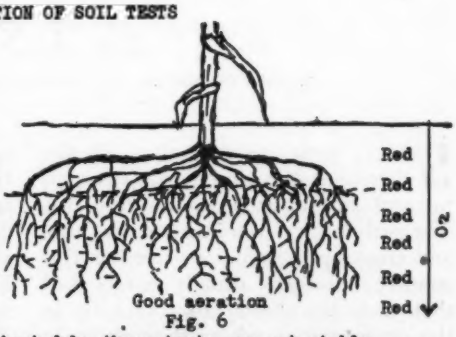


Fig. 6

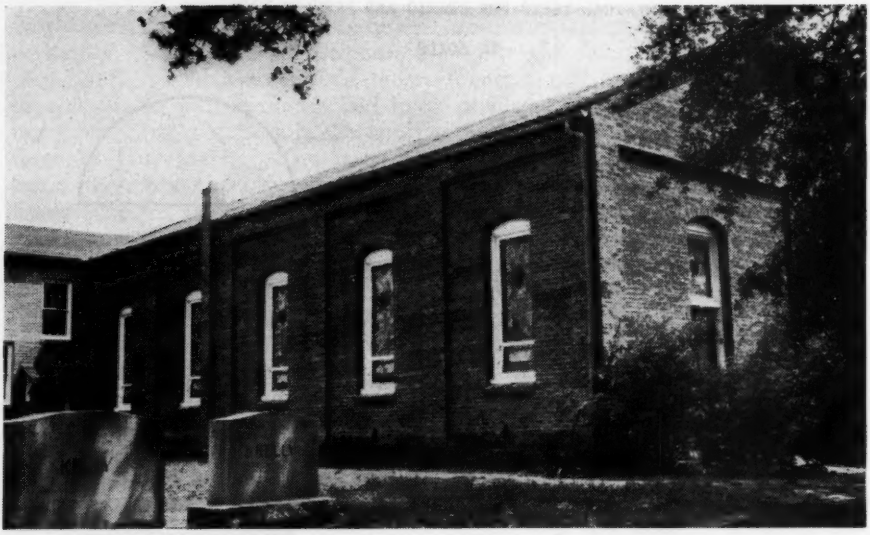
Note: The soil conditions indicated by these tests are not stable. Both ferric and ferrous iron may be found in some tests depending on whether the soil oxygen deficiency is improving or getting worse. Weather conditions, drainage facilities and other factors will aid in the diagnosis.

a hole 12 to 18 inches deep in area to be tested, or use a soil auger if available. Take soil samples at 3-, 6-, 9- and 12-inch depths, deeper if desired, for the tests. Test the samples one at a time from a fresh surface at each level, by the following procedure:

1. Crease a 3- or 4-inch filter paper once.

2. Place two soil samples approximately the size of a navy bean, on the filter paper as shown in Fig. 1. Compress the sample, and then add 2 drops

(*Turn to page* 45)



This rural church, located in a community of good land, reflects the stability and security of the people it serves.

Better Rural Churches Through Wise Land Use

By T. S. Buie

Regional Conservator, Soil Conservation Service, Spartanburg, S. C.

SINCE early pioneer days in the Southeast the church has been an integral part of rural community life. The early settlers were deeply religious, and enjoying the religious freedom this country afforded usually established their churches shortly after arriving in the communities where they chose to live. The first churches were crude, simple structures, but later as the communities grew and prospered, better and more imposing church buildings were erected.

It is not unusual today, however, to find abandoned rural churches in the Southeast, or churches that have declined and are now relatively impotent in community life. At one time these churches were the centers of rural community life, and for most part were adequately supported by their congregations. Various social and economic factors such as periods of agricultural depression, shifts of population, growth of tenancy, and the villageward trend have retarded or adversely affected the rural church; but probing deeper its demise or decline can in many instances be linked directly to land misuse and the attendant loss of productive soil through erosion. The vicious chain of land misuse, erosion, soil depletion, idle land, and lower farm income seriously lowers the efficiency of numerous rural churches, and ultimately may cause the abandonment of many.

In the early days before extensive transportation facilities were developed, each farm or plantation in the Southeast was practically self-sustaining.

This church, located in an area of severely eroded land, contributes on an average only $105 annually toward the support of its pastor.

With the invention of the cotton gin, development of transportation facilities, and an increasing world demand for cotton, the acreage planted to this crop was greatly expanded. More land was cleared and finally steep, hilly fields as well as the more nearly level fields were planted to cotton. Once a field became too badly eroded for economical cotton production, it was abandoned and more new land was brought into cultivation.

Under a cotton economy, the Southeast at first enjoyed considerable prosperity. Fine country homes and plantation mansions were erected. In those days the land produced well and could support such homes. Today, and in striking contrast, many of these homes are badly deteriorated and hardly suitable for human occupancy. In many cases gullies lead almost up to the broad porches of the once stately mansions. As might be expected, when the land declined in productivity and in many cases had to be abandoned, the homes deteriorated. Subsoil farming would not support the homes that had been established by exploiting a fertile topsoil.

Rural churches likewise have been adversely affected by land misuse and erosion. When the land no longer can support good homes, the churches, too, decline. People living on badly eroded land simply are not able to contribute as much as the rural church needs on which to operate efficiently, to pay the pastor, and to keep its building attractive and serviceable.

Although this close relationship between the productiveness of the land and the welfare of the rural church is apparent to those who have studied the soil and its importance to society, as far as could be determined few studies have been undertaken to provide a clear analysis or tangible evidence of this relationship. A recent study of 222 rural churches in the Upper South Carolina Methodist Conference, which embraces the Piedmont section of the State, provides specific data showing the financial support the churches in areas of slightly to severely eroded land receive from their constituent members. For the purpose of this study, the 222 churches were, with the help of technicians of the Soil Conservation Service who were familiar with local land conditions, classified into three groups. Forty-seven churches were placed in

TABLE 1.—MEMBERSHIP AND AVERAGE ATTENDANCE OF 222 RURAL METHODIST CHURCHES, SOUTH CAROLINA PIEDMONT,[1] GROUPED ACCORDING TO DEGREE OF EROSION OF LAND SURROUNDING EACH CHURCH

Degree of erosion	Number of churches	Average membership	Average attendance	Percentage attendance
Moderate	47	160	79	49.4
Moderate to severe	89	132	63	47.7
Severe	86	105	49	46.7

[1] As reported by pastors in charge, October 1942.

the moderately eroded area group; 89 in the group where erosion on the land ranged from moderate to severe, and 86 in the severe erosion group. Expressed in another manner it might be said that 47 of the 222 churches are on good land, 89 on average land, and 86 on poor land.

The average membership of the 222 churches (Table 1) ranged from 160 for those on good land to 105 for those on poor land. Churches in the intermediate group, or on average land, had 132 members. Apparently, those sections that were hard hit by erosion were not able to support a fair-sized farming population, which meant fewer church members. In this case a shift in population affected the church, but basically the cause was one of land misuse which induced erosion. As returns from the land became less and less, its occupants turned elsewhere, many moving from the community. Those who chose to remain on the impoverished land had to remain content with a somewhat lower standard of living.

It was found that the percentage of members attending church more or less regularly was practically as high at churches on poor land as that of churches on the good land—46.7 per cent for churches on poor land and 49.4 per cent for those on good land.

Financial contributions to the 222 churches (Table 2) for all purposes over a 3-year period, 1939 to 1941, were tabulated for each of the three church groups, and here again the close relationship of the land and financial support for the church is borne out. The annual amount contributed to the churches on the good land over the 3-year period averaged $1,135.21 for each church, and for the churches on average land and poor land the amounts were $762.48 and $533.27, respectively. Per capita contributions ranged from $7.09 for those living on the best land to $5.78 for the middle group, and $5.08 for those on the most eroded areas.

Funds contributed for support of the

TABLE 2.—THREE-YEAR AVERAGE OF TOTAL CONTRIBUTIONS FOR ALL PURPOSES AND CONTRIBUTIONS FOR SUPPORT OF PASTOR IN 222 RURAL METHODIST CHURCHES, SOUTH CAROLINA PIEDMONT.[1] CHURCHES GROUPED ACCORDING TO DEGREE OF EROSION OF LAND SURROUNDING EACH CHURCH

Degree of erosion	All purposes		Support of pastor	
	Amount	Per capita	Amount	Per capita
Moderate	$1,135.21	$7.09	$431.37	$2.70
Moderate to severe	762.48	5.78	299.93	2.27
Severe	533.27	5.08	241.09	2.30

[1] Data from Annual Conference Reports of Upper South Carolina Conference.

This is what happens when man misuses land too long and permits erosion to get a head start.

pastor (Table 2) likewise showed a variation consistent with the capability of the land to produce. The average annual salary of the pastor over three years for each church on land with moderate erosion was $431.37, for churches on land with moderate to severe erosion, $299.93, and for churches on severely eroded land $241.09. As may be expected, churches located in the severely eroded areas are being served by the less experienced or less capable pastors. Thus, where we need the best type of church leadership we are likely to find the poorest.

Although there was considerable variation among the three groups of churches in the salaries paid the pastors,

A pleasing new landmark of terraces, strip-cropping, and other soil conservation practices that hold the soil in place and improve its productivity.

the payments made by individual members of the churches for this purpose did not vary greatly. Those members living on the poor, or severely eroded land, paid nearly as much per capita for the support of their pastors as did those on the good or slightly eroded land. Those belonging to churches in the poor land group averaged $2.30 per capita as compared with $2.70 for members of churches on good land. Approximately one-half of the funds raised annually by the churches on the most severely eroded land is used to pay the pastor, but in contrast a much smaller proportion of that raised by well-established city churches—sometimes not more than 1/8 or 1/10 of the total amount raised—is used for this purpose.

Contributions for repairing and maintaining church property were low in the case of churches on severely eroded land. They had available for this purpose only $60.62 annually over the 3-year period as compared with $145.77 for churches on average land, and $195.40 for those on good land. During the three years, annual contributions from Sunday Schools (Table 3) averaged $126.11 for churches on good land, $69.59 for churches on average land, and $50.50 for churches on poor land.

Seventy-nine per cent of the churches on the good land had local units of the Women's Society of Christian Service, but only 45 per cent of those on the poor land supported this activity. Through these societies, the churches on good land each raised (Table 3) an average annual amount during the three years of $71.26, those on average land $49.47, and on poor land, $31.23.

The amounts contributed for orphanage purposes (Table 3) varied directly with the productivity of the land. Churches on the good land each averaged $55.61 annually over the 3-year period, those on average land, $30.18, and on poor land, $23.86. The percentage of churches contributing to orphanages, however, was not noticeably different among the three groups.

Generally, a measure of a church's religious interest is reflected by its contributions to missions and other benevolent causes as benefits from contributions for this purpose are less tangible to church members than those used to support the pastor and maintain the church. Here again the study revealed larger contributions from the better-land churches. Those on good land raised an average amount annually over the three years of $110.82, those on average land, $77.95, and on poor land, $59.32.

Periods of agricultural prosperity, the study showed, are reflected in larger sums raised by churches on the good land, but in contrast the churches on poor land do not benefit as greatly. Generally, the returns from agriculture in 1940 and 1941 were greater than in 1939, and total contributions for churches on the good land were 12.7 per cent greater in 1940 than in 1939, and 16.9 per cent greater in 1941.

TABLE 3.—THREE-YEAR AVERAGE OF CONTRIBUTIONS FOR VARIOUS PURPOSES IN 222 RURAL METHODIST CHURCHES, SOUTH CAROLINA PIEDMONT.[1] CHURCHES GROUPED ACCORDING TO DEGREE OF EROSION OF LAND SURROUNDING EACH CHURCH

Degree of erosion	Buildings and repairs	Sunday School	Women's Society of Christian Service	Orphanage	Benevolences
Moderate	$195.40	$126.11	$71.26	$55.61	$110.82
Moderate to severe	145.77	69.59	49.47	30.18	77.95
Severe	60.62	50.50	31.23	23.86	59.32

[1] Data from Annual Conference Reports of Upper South Carolina Conference.

In the wake of erosion follow poverty, poor homes, poor people.

Churches on average land exceeded their 1939 contributions in 1940 and 1941 by 10.3 and 13.3 per cent respectively. Those on the poor land exceeded the 1939 amounts for the following two years by only 4.2 and 5.2 per cent. Apparently, the churches on the good and average land shared in the farmer's increased prosperity, but church members on poor land did not experience a comparable gain in income, or if they did benefit, they used the money to buy necessities. Generally, times are nearly always bad for farmers on poor land.

From the foregoing study, it is ap-

Farmers who protect their soil against erosion and keep it productive enjoy good returns which enable them to maintain attractive and comfortable homes.

parent that if rural churches on poor, badly eroded land are to be supported adequately, the constituent members must have adequate incomes. On this point church leaders in the Southeast are generally agreed, but the next question they usually pose is, "How can you expect the church member living on a worn-out farm to increase his income?"

Obviously, farmers cannot recapture the topsoil which has washed away from their fields; neither is there any magic formula for transforming infertile soil into fertile soil overnight. Keeping good soil productive is in itself a task, and to restore worn-out, badly eroded fields so they will produce good yields requires careful planning, work, and patience.

During recent years, however, thousands of Southeastern farmers have demonstrated that they can improve their land, including worn-out areas, and increase crop yields substantially. They are following well-rounded soil conservation programs in which every acre is put to the farming use to which it is best adapted, and using appropriate erosion-control methods. The conservation plans for individual farms are supplied by farmer-operated soil conservation districts with which the Soil Conservation Service and other agricultural agencies cooperate.

At present there are 208 soil conservation districts, embracing 157 million acres, in the nine Southeastern States south of the Ohio and Potomac Rivers and east of the Mississippi River. The rapid organization of districts by farmers in recent years indicates that they welcome this approach to a solution of their soil and water conservation problems. It was in 1937 that the states began passing enabling laws under which farmers could set up districts and operate them. Since that time the districts in the Southeast with the help of the Soil Conservation Service have developed complete conservation plans for 80,000 farms covering more than 13 million acres. Many districts also have effectively utilized the services and various types of assistance available from other agricultural agencies and workers such as the State Experiment Stations and Extension Services, Agricultural Adjustment Agency, Farm Security Administration, and Vocational Agriculture Teachers.

Results of Conservation Practices

A survey made late in 1943 of 1,469 representative farms in soil conservation districts in the Southeast showed that after 2 or 3 years of conservation farming the owners had increased their total annual corn production from 1,132,634 to 1,258,121 bushels, or 125,487 more bushels. They did this, however, on 45,165 acres, which was 13,992 acres less than their former corn acreage of 59,157. By using the land best suited to growing corn and employing conservation measures, the per-acre yield was increased from 19.1 to 27.9 bushels.

The cotton acreage was reduced from 37,548 to 29,791 acres, or 20 per cent, but the yield of lint cotton per acre increased from 295 to 408 pounds, which resulted in producing 24,298 bales on the smaller acreage as compared with 22,157 bales on the larger acreage. Better per-acre yields were also reported by the 1,469 farmers for wheat, oats, barley, peanuts, tobacco, and other crops.

The increased production of feed as a result of the improved land use program on these 1,469 farms was reflected in increased numbers of livestock. Dairy cows increased from 7,734 to 10,858, or 40 per cent. Beef cows increased from 7,940 to 17,754, or 124 per cent; and the number of calves raised increased from 6,172 to 13,131, or 113 per cent, the farmers reported. The number of hogs increased from 30,860 to 61,576, a gain of nearly 100 per cent; sheep from 8,179 to 14,348, or 75 per cent; and chickens from 127,714 to 225,491, or 77 per cent. Annual milk production increased from 22,592,000 pounds to 38,643,000 pounds, or 71 per cent; and eggs from 866,000 dozen to 1,580,000 dozen, or 83 per cent.

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Fertilizers for Cotton and Corn Following Lespedeza

By Hayden Rogers

Associate Agronomist, Alabama Agricultural Experiment Station, Auburn, Ala.

THE annual lespedezas are grown principally in northern Alabama for hay, pasture, and soil building. Lespedeza is quite tolerant to soil acidity, and because of its strong feeding habits, it often produces a profitable crop on soils which will not support alfalfa, red clover, white clover, etc. This fact has led many farmers to believe that lespedeza will grow just as well without fertilizers as with them.

Cotton, following lespedeza, was not fertilized. Yield—520 lbs. of seed cotton per acre.

Cotton, following lespedeza, was fertilized with 300 lbs. of 0-16-16. Yield—1,500 lbs. of seed cotton per acre.

Analyses of lespedeza hay as given by Henry and Morrison, "Feeds and Feeding," show that it contains large amounts of nitrogen, phosphorus, and potassium. These analyses show that two tons of lespedeza hay contain nitrogen equivalent to 485 pounds of 16 per cent sodium nitrate, phosphoric acid equivalent to 230 pounds of 18 per cent superphosphate, and potassium equivalent to 140 pounds of 60 per cent muriate of potash. Being a legume, lespedeza is able to obtain most of its nitrogen from the air, but all of the phosphorus and potassium must be taken from the soil in which it grows. Unless proper fertilizers are used, it may so deplete a soil of its minerals that crops following it cannot be grown successfully.

Results of Cooperative Experiments[1]

A number of farmers in northern Alabama have experienced failures or near failures of cotton and corn when either of these crops was planted after Korean or one of the other annual lespedezas. These failures have occurred principally on the gray soils of the Highland Rim, the white bottom lands of the Tennessee and Coosa Valleys, and the soils of Sand Mountain. Table 1 gives a summary of the experiences farmers have had with

[1] These tests were inaugurated by Captain P. B. Gibson, formerly Graduate Assistant in the Department of Agronomy and Soils, Alabama Polytechnic Institute.

TABLE 1.—A COMPILATION OF DATA ON THE DISTRIBUTION AND THE CONDITIONS UNDER WHICH INJURY FROM TURNING LESPEDEZA OCCURS. OBTAINED FROM QUESTIONNAIRES WHICH WERE ANSWERED BY AGRICULTURAL WORKERS IN NORTH ALABAMA.

No.	Soil	Years in lesp.	Part turned	Fertilizer applied to lesp.	Crop succeeding lespedeza	Fertilizer applied to crop	Date turned	Remarks
1	Hartselle	3	Stubble	None	Corn	NaNO(1)	Fall	No growth, remained yellow all season.
2	"	3	Stubble	300# (2)	Cotton	600# 6–8–4	Spring	Half normal crop.
3	"	6	Full growth	None	Soybeans	None	Fall	Plants died 30 days after planting.
4	Gray Land(3)	3	Grazed and turned	None	Cotton	200# 6–8–4	Spring	Some plants died. Yield 160# lint.
5	" "	3–4	Full growth	None	Cotton	200# 6–8–4	Fall	Had to replant. Yield 300# lint.
6	" "	3	Stubble	None	Cotton	6–8–4(1)	Fall	Turned yellow and rusted. Some plants died.
7	" "	3	Stubble	None	Cotton	175# 3–8–5	Fall	Small plants, leaves fell, yield 200# lint.
8	" "	2	Full growth	None	Cotton	200# 6–8–4	Spring	Some young plants died, plants stunted, yield 250# lint.
9	" "	3	Stubble	None	Cotton	300# 6–8–4	Spring	Yield higher than yield of crop not following lespedeza.
10	" "	3	Full growth	None	Cotton	300# 6–8–4	Fall	Early growth stunted, then satisfactory.
11	" "	2	Stubble	None	Corn	100# 0–16–0	Fall	Yellow streaks appeared in leaves then turned brown and died.
12	" "	3	Stubble	None	Corn	200# 0–16–0	Spring	Yellow and stunted. Yield 5 bushels.
13	" "	2	Stubble	None	Corn	100# 3–8–4	Spring	Young plants, yellow, recovered, yield 10 bushels.
14	" "	3	Stubble	None	Corn	100# 0–16–0 150# 16–0–0	Spring	Satisfactory growth.
15	" "	5	Grazed	None	Corn	None	Spring	One-third more than corn after corn.
16	All types in County(4)	2–5	.....	None	.....	150–300# (2)	.....	Young plants yellow, then gain color.

1 Amount not given.
2 Kind not given.
3 Soils of the Dickson-Baxter area of the Highland Rim soil province.
4 County Agent of Lauderdale County filled out one questionnaire to be representative of entire county.

crops following lespedeza in that part of the State. It should be noticed that some of these crops made satisfactory growth, while others were classed as failures.

The results of an experiment conducted in 1941 in Limestone county on Dickson silt loam soil are given in Table 2. This area had been in lespedeza a number of years as a part of the general farm program. Nitrogen and phosphate applied to cotton increased the yield 152 pounds of seed cotton over the unfertilized plot. When potash, equivalent to 50 pounds of muriate of potash, was added to the nitrogen and phosphate, the increased yield was 641 pounds more of seed cotton than the check plot. By adding an extra 150 pounds of muriate of potash to the complete fertilizer, the yield was increased by 101 pounds of seed cotton. A fertilizer containing only nitrogen and potash produced 276 pounds more of seed cotton than the unfertilized plot. The addition of minor elements to the complete fertilizers resulted in an increase of only 51 pounds of seed cotton. An extra application of sodium nitrate actually caused a reduction in the yield.

TABLE 2.—COTTON FOLLOWING LESPEDEZA. DICKSON SILT LOAM SOIL, LIMESTONE COUNTY.

Fertilizer treatment per acre	Pounds of seed cotton per acre	Increase due to treatment
No fertilizer	292	
600 lbs. 3–8–0	444	152
600 lbs. 3–8–5	933	641
600 lbs. 3–0–5 plus 150 lbs. muriate of potash	568	276
600 lbs. 3–8–5 plus 150 lbs. muriate of potash	1,034	742
600 lbs. 3–8–5 plus 150 lbs. muriate of potash and minor elements(1)	1,085	793
600 lbs. 3–8–5 plus 350 lbs. sodium nitrate	849	557

[1] 10 lbs. $CuSO_4$, 10 lbs. $ZnSO_4$, 10 lbs. $MnSO_4$, 10 lbs. borax, and 75 lbs. dolomite per acre. This mixture was used in all treatments where minor elements were applied.

TABLE 3.—CORN FOLLOWING LESPEDEZA. DICKSON SILT LOAM SOIL, LIMESTONE COUNTY.

Fertilizer treatment per acre	Bushels of corn per acre	Increase due to treatment
No fertilizer	20.1	
600 lbs. 0–8–0	27.2	7.1
600 lbs. 0–8–5	30.8	10.7
600 lbs. 0–0–5 plus 150 lbs. muriate of potash	30.8	10.7
600 lbs. 0–8–5 plus 150 lbs. muriate of potash	32.9	12.8
600 lbs. 0–8–5 plus 350 lbs. sodium nitrate	32.5	12.4
600 lbs. 0–8–5 plus minor elements	39.3	19.2

The results of the test with corn on the same area are shown in Table 3. When the corn was fertilized with approximately 300 pounds of superphosphate per acre, the yield was increased 7.1 bushels. The addition of 50 pounds of muriate of potash to the phosphate produced an increase of 10.7 bushels of corn over the unfertilized plot. Muriate of potash at the rate of 200 pounds per acre did not produce any more corn than did the 50 pounds of muriate. When 350 pounds of sodium nitrate per acre were applied with the phosphate and potash, the increased yield over the check plot was 12.4 bushels. Minor elements in combination with phosphate and potash produced 19.2 bushels of corn more than the unfertilized plot.

In 1942 five tests were conducted in cooperation with farmers in the Highland Rim soil province of Alabama. The results of these tests are given in Table 4. All of these plots were located on fields that had been in lespedeza for at least two years. Three-hundred pounds of 0-16-0 applied at the time the cotton was planted increased the

(*Turn to page* 42)

Cereal hays respond well to spring applications of nitrogen, particularly on the upland soils. Yields per acre of oat hay in the plots on Lauren sandy loam in Clark County were as follows: Check, 2,641; 100 lbs. sodium nitrate, 4,530; 200 lbs. sodium nitrate, 8,233; 300 lbs. sodium nitrate, 7,822 lbs. per acre.

Fertilizers Pay Their Way In Western Washington

By Karl Baur

Soil Scientist, Western Washington Experiment Station, Puyallup, Wash.

IN the western part of Washington, the most northwesterly state in the union, farmers and investigators alike have learned that the use of commercial fertilizers in a well-managed farm program is good business.

Not so many years ago all of the areas now farmed, with the exception of a few small grass-covered prairies and small areas of river delta land, were covered with tremendous stands of Douglas fir, hemlock, spruce, cedar, alder, and maple. Some clearing was started about 100 years ago, but the real conversion from stump and timber land to agronomic agriculture did not begin until 50 or 60 years ago.

Today it is still the most important timber area in the United States, but farming is now the means of livelihood of a great part of the people of western Washington. It is an area where farmers and shippers emphasize the quality of their products. It is a land of butter and milk, eggs and other poultry products, high quality frozen peas, beans, corn, and other frozen and canned vegetable products. The high quality of its strawberries, raspberries, and other cane fruits is recognized by the trade throughout the country. Its specialty crops of daffodils, tulips, and other flowering bulbs, of lawn grass seeds, of roses and rhodo-

dendrons, and other ornamental and agricultural nursery stocks add to the list of products that are grown for local consumption and for sale abroad. Ninety per cent of the cabbage seed, a large portion of the spinach, table beet, turnip, and other vegetable seeds are grown here.

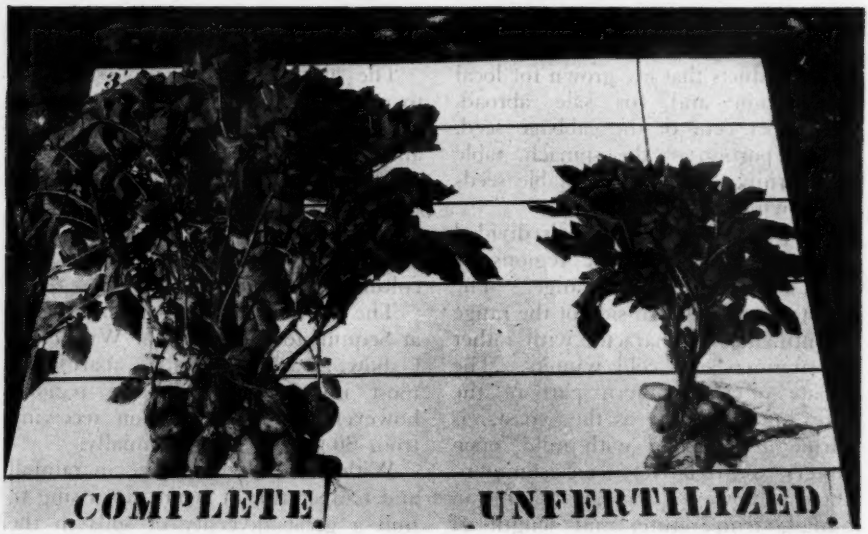
The State of Washington is divided into two distinct climatic regions by the Cascade mountain range. The climate on the eastern side of the range is continental in character with rather hot summers and cold winters. The climate of the western part of the State, known locally as the "coast," is marine in character with mild, open winters and relatively cool summers. There is, however, a great variation in rainfall, temperature, and length of frost-free period, depending on latitude, altitude, proximity to large bodies of water, mountain ranges, etc. For example, the areas immediately adjacent to the Puget Sound are known to be warmer and more frost-free than localities only 20 miles inland. The airline length of western Washington (M-S) is about 180 miles. No part of the region is outside the view of snow-covered mountains even in midsummer.

The altitude varies from sea level to over 14,000 feet on the summit of Mt. Rainier. Most of the good soils and practically all of the agriculture are found at elevations below 600 feet. A few small, diversified farms are found at higher elevation, but these comprise a very small part of the agriculture of the area.

The rainfall varies from 14 inches at Sequim to 140 inches at Wynochee-Oxbow, areas only 60 miles apart. The most important agricultural regions, however, are in the section receiving from 30 to 60 inches annually.

With such a wide range in rainfall and temperature it is not surprising to find a great diversity of soils in the area. The northern half of western Washington has been subjected to glaciation from the ice sheets from the north and from local Cascadian glaciers, and has a relief common to glaciated areas. Even at the present time the larger streams have as their sources glaciers found on the slopes of the higher mountains in the Cascade range. These streams are re-

Tall Alderman peas on muck soil near Sumner, Washington, sidedressed with 800 lbs. per acre of 3-10-10 fertilizer.



Plants from fertilized and unfertilized rows of potatoes grown on Bellingham silt loam, Whatcom County.

sponsible for the formation of the excellent riverbottom soils of the Puget and related series, the most productive of the mineral soils in western Washington. The soils of the Puget and related series are used most extensively for the specialized crops mentioned earlier in this paper. These soils range in texture from coarse sandy loams to silty clay loams and are generally friable and relatively easy to work.

The upland soils belonging to the Everett, Alderwood, Whatcom, and related series are found on the hills of the northern half of the area. The agricultural use of these soils is more limited because of their lower water-holding capacity, the presence of stones, hardpans in the profile, and other characteristics which lower their productive capacities.

Most of the peat and muck soils are found in this northern section of western Washington. Many of these are very productive and when properly fertilized produce excellent yields of a wide range of crops. About the only crops that are not commercially grown on muck soils are tree fruits, raspberries, and strawberries. The yield of vegetables and forage grasses is particularly high under proper systems of soil management. For example, over 6,500 pounds of dry matter per acre were produced on heavily fertilized muck on the farm of the Western Washington Experiment Station. There are a few hundred acres of muck soils in Whatcom County that are relatively undeveloped, but for the most part they are used rather intensively wherever found.

The alluvial soils of the southern half of western Washington are known as the Chehalis, Newberg, Wapato, and related series. These differ greatly from the alluvial soils of the northern half of the area since they are derived from residual and marine soils of the Olympic and Melbourne soils, respectively. The variety of crops grown commercially on these soils is much narrower than those grown on the Puget soils. There are relatively large areas of hill and terrace soils in the southern area that are well adapted to agriculture, particularly for the growing of grains and for livestock farming. Because of the great diversity of soils as a result of climate and a wide

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Bigger Yields from Fertilizers

By V. A. Tiedjens

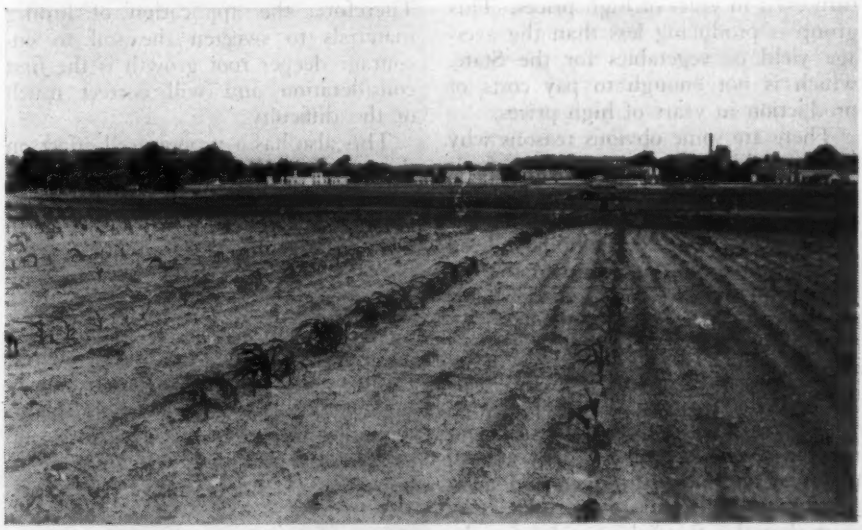
Agricultural Experiment Station, New Brunswick, New Jersey

IN 1940 not more than one per cent of the tomato growers in New Jersey plowed under all their fertilizer, despite the fact that the Department of Vegetable Gardening had recommended the practice since 1936. Since 1941 the number of growers following the practice has rapidly increased, so that by 1944 approximately 50 per cent of the growers are plowing under all or part of their fertilizer. Along with this, liming materials in greater amounts are being plowed under.

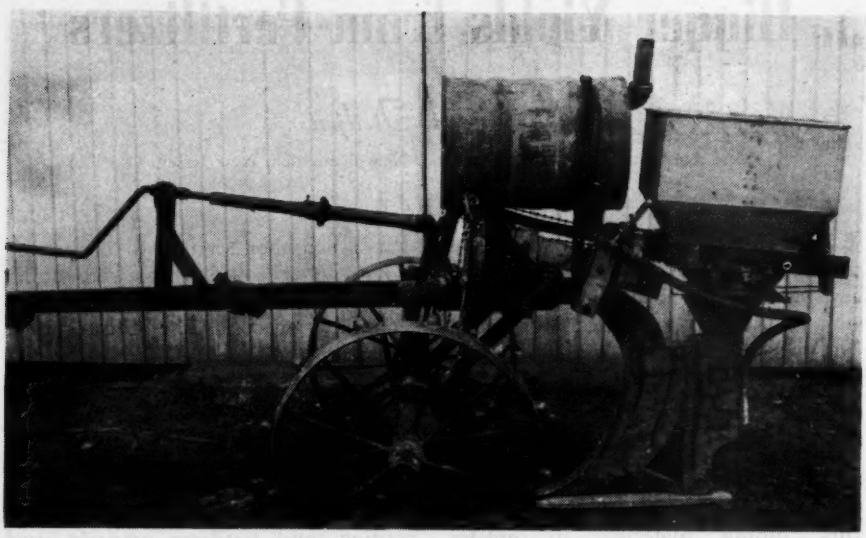
From a theoretical standpoint, one can present a number of valid reasons why this has come about. From a practical standpoint, one must look for some psychological reason. If you ask farmers why they adopted the practice of plowing under the fertilizer, the answer usually involves the fact that a neighbor seemed to be getting along better and he plowed under fertilizer, or So and So won the Ten-Ton Club award and he plowed under fertilizer.

More tons mean more money per acre, and since most farmers farm land to make money, anything that helps to bulge the pocketbook carries an appeal. In other words, more units per acre lower the unit cost to meet competition, and fertilizer properly used plays a big role in getting these additional units. There are many growers in New Jersey who do not get enough additional units to pay for the fertilizer they use because they do not use it properly.

With weather conditions beyond their control and prices an unknown quantity, growers are faced with the



The corn in the best looking row (left of center) received 450 gals. per acre of a fertilizer solution made up by dissolving 3 lbs. of 13-26-13 in 50 gals. of water in addition to 500 lbs. per acre of dry 5-10-5 fertilizer. The center row received only water and the dry fertilizer at the same rates. The other rows in the field received only the dry fertilizer. Farm of Fred H. Bateman, Grenloch, N. J.



Equipment for applying dry limestone or fertilizer, or a solution of fertilizer, in the subsoil.

necessity of getting the largest possible tonnage from their soil at the minimum cost. Approximately 10 per cent of our growers seem to do this and another 40 per cent could, with very little change in their farming practice. But we have another 50 per cent who have not been getting a satisfactory return even in years of high prices. This group is producing less than the average yield of vegetables for the State, which is not enough to pay costs of production in years of high prices.

There are some obvious reasons why we have this group. Part of the fault can be attributed to the managerial ability of the grower, but there are enough cases of growers who have been lifted from the 3-ton group to the 12-ton group by adjusting lime and fertilizer usage to warrant putting much of the blame on their soil condition and manner of using commercial fertilizer. Such problems as insufficient use of liming material, improper use of chemical fertilizer, improper use of animal manure, and poor drainage and aeration of the soil—all seem to play their part, but the first two are by far the biggest obstacles to overcome.

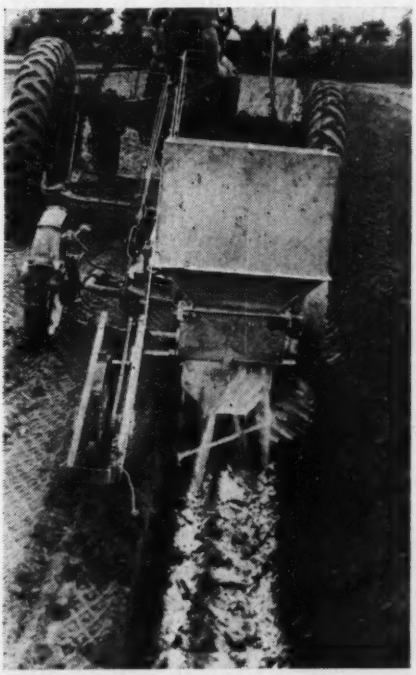
Drainage and aeration do not mean low-lying ground. They refer to soils which, because of their chemical condition, do not permit ready movement of water into the subsoil. This condition has been brought about because lime has not been used in adequate amounts to keep the subsoil properly saturated with calcium and magnesium. Therefore, the application of liming materials to sweeten the soil to encourage deeper root growth is the first consideration and will correct much of the difficulty.

This also has a pronounced effect on the plant's utilization of the fertilizer and determines how effective any particular placement of the fertilizer is in increasing yields. One of our market gardeners has used 14 tons of pulverized limestone per acre in seven years and has changed his soil from a shallow-rooting medium, where much of the rainfall ran off, to one in which the roots of vegetable plants penetrate into the lower horizons and which can be cultivated a couple of hours after a heavy rain.

When the soil is in good condition, the problem of where to place the fertilizer to get the most good out of it is very much simplified. It makes pos-

sible the ready diffusion of soluble salts. By promoting deeper rooting, a greater moisture supply is assured, making it possible to grow bigger yields during dry weather.

When judging the most effective placement of fertilizer, we must not only avoid fertilizer injury to the growing plant, but we must place the fertilizer where it will be available to the crop in the proper concentration. For instance, by placing it in narrow bands on either side of the row of plants we have eliminated fertilizer injury, which incidentally means increased yields; but from cooperative experiments with the late Fred H. Bateman, it was quite evident that there were other placements which gave still further increases in yield. Placing the bands as deep as possible with machinery gave increased yields and presented evidence indicating an entirely new approach to fertilizer placement involving both liquid and dry applications.



Applying fertilizer on the bottom of the plow furrow by means of a home-made attachment on the plow.

Carrying the problem to further seemingly ridiculous applications, we have found that superphosphate placed in the subsoil 4 to 6 inches below the plowed layer, with an application of limestone where necessary, has given us still further yield increases with a much greater root distribution. Where formerly all the roots were in the upper 6- to 8-inch layer, it has been possible to find roots 3 feet deep accompanying the deep application of limestone and superphosphate. This is true on the typical coastal plain soils, but may not always be true where appreciable quantities of organic matter are present.

This was demonstrated on one of our market gardens on a white sandy soil with a poor profile development. A series of plots were established with market tomatoes as the indicator crop. Due to the open structure of the soil, this grower had always applied his fertilizer, 1,200 lbs. of 5-8-7, in two side-dressings after having set the plants with a transplanting solution. The subsoil was a fine, dense, white sand.

His plants in previous years always showed erratic growth because of variable weather conditions, and the roots never penetrated the soil below the plowed layer. Several of our treatments were designed to encourage deeper rooting. Summarizing the results, the following practices were found to be better than his own treatments.

Using his regular treatment, a subsoiler was run along the row to a depth of 15 inches before the plants were set. This promoted deeper root growth and improved the quality of the fruit. Placing limestone in the bottom of the plowed furrow or in the subsoil gave even better results.

Placing all the fertilizer in the subsoil with some limestone, but setting plants with a transplanting solution, was the best treatment. It only increased his yield 25 to 30 per cent, but it improved the quality of the fruit so much that for every dollar he took

in from his own treatment, he took in three dollars from this method. The plants were not as dark green as with his treatment, but they had a heavy crown set of large fruit, and the size of fruit held up to the end of the picking season. Plants from his own method were greener, softer in texture, and had only a few tomatoes on the crown or first cluster of flowers, although the total number of tomatoes set was higher. His plants wilted on hot days. This did not occur where the fertilizer was placed deep. It took 175 to 225 tomatoes for a bushel from his treatment and 125 from the plots which had the fertilizer placed deep. The larger tomatoes brought more money and there seemed to be less sunscald on the fruits. Had he sold to the canning factory, the difference in money returns would not have been so great.

Placing the fertilizer in the bottom of the plowed furrow on this same soil or plowing it under for sweet potatoes gave as good or better yields than where it was placed on the surface as a side-dressing.

Deep Placement and Leaching

The first question that comes up is whether fertilizer placed so deep leaches away. It has been our observation that leaching from heavy rains must be considered in terms of where the roots are distributed. The growth of the plants may be affected more by leaching where the fertilizer is applied as a side-dressing and the roots are shallow than where the fertilizer is placed in the subsoil because the roots penetrate to much greater depths. Phosphorus does not move around very much, but the nitrates and potash move up and down, according to rainfall. Roots that have penetrated to a depth of three feet would have much more opportunity to grab the nitrates and potash than if they were distributed near the surface. Furthermore, the more soluble portions of fertilizer placed deeply in the soil tend to move toward the surface while the more insoluble portions, being in an environment of more uniform moisture supply, are more readily available for absorption by the roots. Deep placement also prevents loss of phosphorus by surface erosion which, in some cases, runs into alarming proportions.

In checking on the fertilizer ingredients to find which one is more closely related to stimulation of crop yields when deeply placed, it seems that the problem involves phosphorus much more than it does nitrogen and potash. In experiments where only phosphorus was placed deeply and nitrogen and potash were side-dressed, the yields were as good or better than where the complete fertilizer was placed in the subsoil. There have been indications that too much fertilizer placed in a band in the subsoil can depress the yield. Comparing dry and liquid applications in the subsoil, the fertilizer solution has produced larger yields with the same amount of fertilizer, if moderate amounts are used. Using 1,200 to 2,000 lbs. in an application, it takes less fertilizer in solution to depress the yield than when applied dry. Since there is some indication that this is caused by the greater amount of phosphorus in solution, a comparison of a 5-10-10 with a 5-5-10 mixture was made. The yield from the 5-5-10 mixture in solution was definitely higher than from the 5-10-10 in solution. However, we have only one year's results to back this statement and we must not jump to conclusions.

Although we have not had the equipment to distribute the fertilizer in a larger area of the subsoil on a sufficiently large scale, it seems reasonable to assume that for large quantities of fertilizer, above 1,000 lbs., our crop yields would benefit by large quantities of fertilizer in solution if we could distribute it in a larger area of the soil. Even though the placement of 500 to 1,000 lbs. of fertilizer in deep bands seems to give us an excellent response,

(*Turn to page* 43)

PICTORIAL

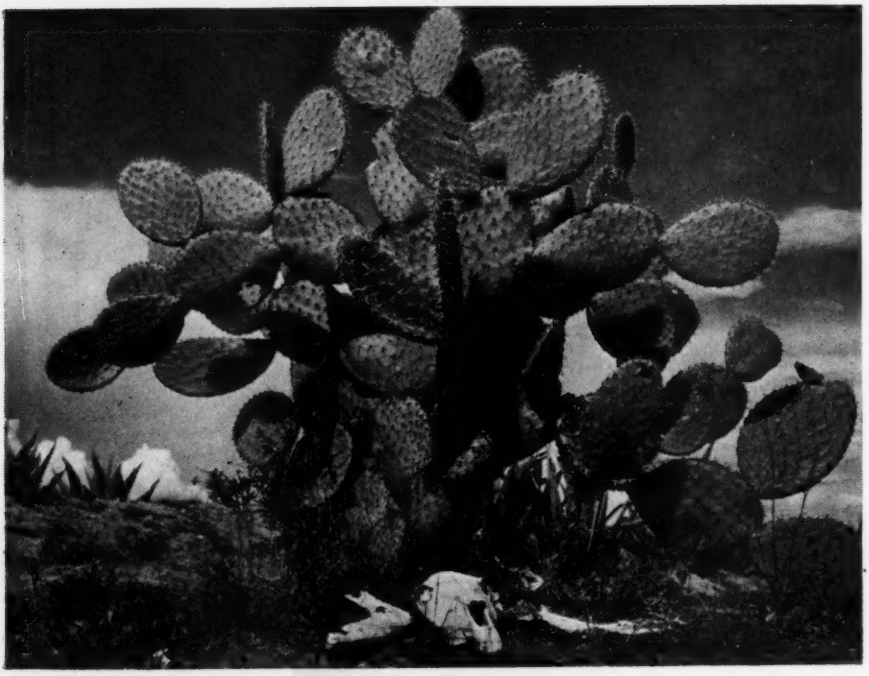
COOPERATION IN ITS EARLY STAGES

Left: Barbecued chicken —Um-m-m-m!

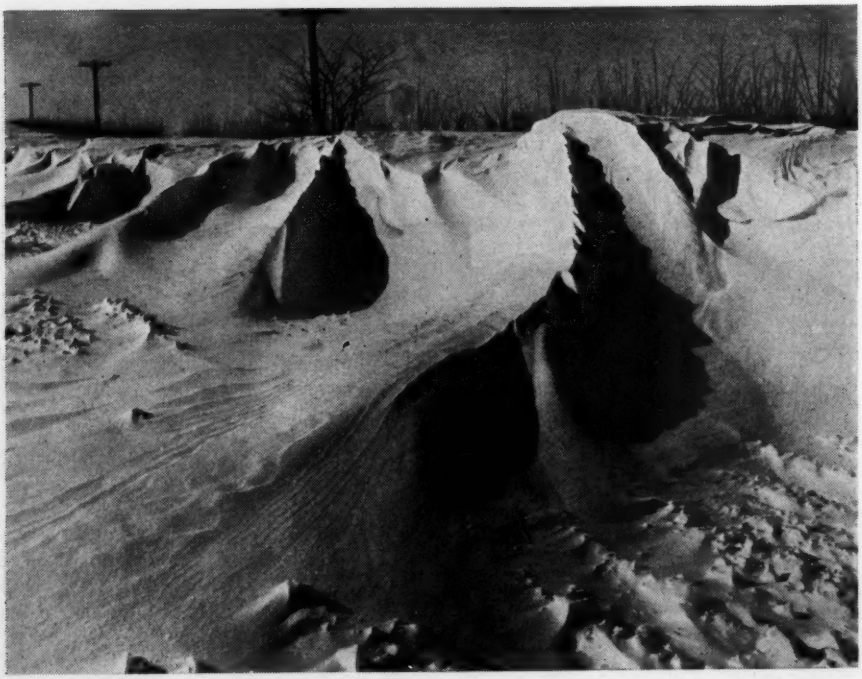
Below: Who has been scared most?

Right: The mail got through.

Below: More for exercise than feed.



NATURE VARIES HER WINTER SCENES



The Editors Talk

Again in 1945

Final agricultural production goals for 1945 were announced by War Food Administrator Marvin Jones on January 16. Again, the farmers of the Nation are being called upon to beat all previous records. To many of them this will seem an insurmountable task in the face of no appreciable betterment in the farm machinery situation, greater inroads by the Armed Services on the young farm men of draft age, and still tight supplies of fertilizer. However, they have done it before and in all probability they will do it again. The resourcefulness of the American farmer is one of the miracles of this war.

The crop goals for 1945 involve some shift in the pattern of production in line with the changing demand situation. The total crop acreage of 363,635,000 is nearly 3% larger than the 1944 planted acreage. Acreage goals for flaxseed, sugar beets, and cover crop seeds have been materially increased over 1944. Moderate increases are shown for dry beans, potatoes, and tobacco. The goals for legume hay seeds and for soybeans are maintained at the record 1944 levels.

The goals call for increased milk production and for a larger slaughter of cattle to meet the increased military and civilian demands for meat. The War Food Administration recently urged farmers to keep more sows for spring farrowing. Because of recent changes in needs, the 1945 egg goal has been increased by about 10% over the preliminary goal. Recent increases in military needs have resulted in an increase in the pack goals for vegetables for processing.

Regarding the supplies which the farmers will have to work with in their efforts to meet the new goals, Frederic B. Northrup, Director, Office of Materials and Facilities, War Food Administration, at a meeting of the National Committee for Farm Production Supplies in Chicago on January 9 had this to say about the farm machinery picture: "This year's program is about the same as last year's program but less than last year's total production. Labor-saving machinery is again emphasized. But production of many items is running considerably behind schedule. Care, share, and repair will be essential once again."

Regarding fertilizer, he said: "Prospects for nitrogen and superphosphate have been going down, due to military demands for some of the materials used in fertilizer production. Of course we expect to have more nitrogen and superphosphate than we used in the prewar years of 1935-9—60% more nitrogen and 54% more super. But we'll have perhaps 10% less nitrogen and 7% less super than we had last year. Potash is better. We'll have nearly twice as much as we used in the years just before the war and 20% more than last year. That brings our total supply of commercial plant food to about the same tonnage as last year. But the tonnage of approved grades high in nitrogen will be lower. We'll have less superphosphate for straight use. The approved grades high in potash content should be more abundant."

He went on to say: "I trust it has not escaped the attention of anyone concerned that the Government, the fertilizer industry, colleges, and others have been

asking farmers to take early delivery of the fertilizer they need for the coming crop season. It's getting late, but anything you can still do to move fertilizer early will be a big help to the industry and the whole country. Due to manpower and transportation problems, failure to move the stuff early could limit the total amount received and used by farmers in 1945. Early movement improves the chance of meeting farm requirements as fully as supplies of material permit."

Administrator Marvin Jones, in announcing the 1945 goals, declared that food production this year will be just as important to the war as it was in 1944. He feels confident that despite the difficulties and barring adverse weather, this year will be another one of splendid farm achievement.

Conserving While Going All-out

That the Nation's farmers can and are conserving their soil resources while producing record-breaking crops are verified in the 1944 report of N. E. Dodd, chief of the Agricultural Adjustment Agency, and the Agency's program for 1945. Total assistance to farmers and range land operators for conservation practices completed under the 1944 AAA program is indicated at around 300 million dollars, compared with 215 million in 1943, and 168 million dollars in 1942. In addition, AAA records show that its assistance has stimulated the carrying out of practices beyond those for which aid is provided. The cropland on farms participating in the 1943 AAA conservation program comprised 89% of the Nation's cropland. Some 60 different soil- and range-building practices were carried out with AAA assistance. The 6½ million individuals who received this assistance operated or had an interest in more than 4,427,000 farms.

Since 1936, the year the AAA conservation program first became effective, crop yields have increased steadily; during the war years they have averaged more than one-fourth higher than the 1923-32 average. The report stresses that AAA conservation practices not only have helped to increase crop yields and farm income, they also have restored vital minerals to the soil, which in turn improved the food and feed consumed by people and livestock.

Commenting on the need for even wider application of conservation methods by farmers, Mr. Dodd said, "All-out production during these war years, despite special emphasis on soil-conserving practices, has exacted a price. Increased acreage in soil-depleting crops has resulted in unbalanced crop rotations and decreased permanent land cover—a net loss in soil fertility.

"While this loss is not yet evident in total production, continued drains on limited soil resources cannot fail to reduce yields. The main balance sheet looks good for agriculture. But several immediate problems are pressing for attention, including the serious one of restoring our soil to a safe level of fertility, on which the health, character, and material well-being of this country depend."

Payments under the 1945 AAA program will be offered for these general types of practices: (1) Application of lime, fertilizers, and other materials to crops; (2) planting of cover crops; (3) harvesting of legume and grass seeds; (4) erosion control and water conservation; (5) range and pasture improvement; (6) forestry; (7) other practices such as noxious weed control and renovation of perennial legumes and grasses.

Assistance is given farmers either in conservation materials, services, purchase orders, or payments. The materials are purchased through regular commercial trade channels wherever practical. The assistance offered is designed to represent a part of the cost of carrying out the conservation practices on the land.

Farm Prices of Farm Products*

	Cotton Cents per lb.	Tobacco Cents per lb.	Potatoes Cents per bu.	Sweet Potatoes Cents per bu.	Corn Cents per bu.	Wheat Cents per bu.	Hay Dollars per ton	Cottonseed Dollars per ton	Truck Crops
1910–14 Average	12.4	10.4	69.6	87.6	64.8	88.0	11.94	21.59	....
1920	32.1	17.3	249.5	175.7	144.2	224.1	21.26	51.73	....
1921	12.3	19.5	103.8	118.7	58.7	119.0	12.96	22.18	....
1922	18.9	22.8	96.7	104.8	58.5	103.2	11.68	35.04	....
1923	26.7	19.0	84.1	104.4	80.1	98.9	12.29	43.69	....
1924	27.6	19.0	87.0	137.0	91.2	110.5	13.28	38.34	....
1925	22.1	16.8	113.9	171.6	99.9	151.0	12.54	35.07	....
1926	15.1	17.9	185.7	156.3	69.9	135.1	13.06	27.20	....
1927	15.9	20.7	132.3	114.0	78.8	120.5	12.00	28.56	....
1928	18.6	20.0	82.9	112.3	89.1	113.4	10.63	37.70	....
1929	17.7	18.6	93.7	118.4	87.6	102.7	11.56	34.98	....
1930	12.4	12.9	124.4	115.8	78.0	80.9	11.31	26.25	....
1931	7.6	8.2	72.7	92.9	49.8	48.8	9.76	17.04	....
1932	5.8	10.5	43.3	57.2	28.1	38.8	7.53	9.74	....
1933	8.1	12.9	66.0	59.4	36.5	58.1	6.81	12.32	....
1934	12.0	17.1	68.0	79.1	61.3	79.8	10.67	26.12	....
1935	11.6	16.1	49.4	73.9	77.4	86.4	10.57	35.56	....
1936	11.7	17.2	99.6	85.3	76.7	96.0	8.93	31.78	....
1937	11.1	19.9	88.3	91.8	94.8	107.1	10.36	30.24	....
1938	8.3	17.2	55.5	76.9	49.0	66.1	7.55	21.13	....
1939	8.7	13.6	68.1	75.4	47.6	63.6	6.95	22.17	....
1940	9.6	15.1	70.7	85.2	59.0	73.9	7.62	24.31	....
1941	13.3	19.1	64.6	94.4	64.3	84.0	8.10	35.04	....
1942	18.51	28.3	110.0	108.3	79.5	101.8	10.05	44.42	....
1943	19.84	32.5	149.2	196.7	102.7	127.3	12.82	48.26	....
1944									
January	20.15	41.5	141.0	202.0	113.0	146.0	15.70	52.80	....
February	19.93	25.1	139.0	211.0	113.0	146.0	15.90	52.60	....
March	19.97	21.9	137.0	220.0	114.0	146.0	16.00	52.70	....
April	20.24	23.8	137.0	229.0	115.0	147.0	16.20	52.50	....
May	19.80	37.2	134.0	236.0	115.0	147.0	16.10	52.50	....
June	20.16	49.2	125.0	233.0	115.0	143.0	15.00	52.80	....
July	20.32	45.0	138.0	230.0	117.0	139.0	13.90	53.00	....
August	20.15	39.3	159.0	258.0	117.0	135.0	14.30	53.20	....
September	21.02	42.9	147.0	219.0	116.0	135.0	14.70	52.30	....
October	21.25	41.2	142.0	185.0	113.0	142.0	15.20	52.70	....
November	20.78	45.1	143.0	164.0	106.0	143.0	15.60	53.40	....
December	20.85	43.5	150.0	175.0	106.0	145.0	16.50	53.10	....
Index Numbers (1910-14 = 100)									
1920	259	166	358	201	223	255	178	240	....
1921	99	187	149	136	91	135	109	103	....
1922	152	219	139	120	90	117	98	162	....
1923	215	183	121	119	124	112	103	202	....
1924	223	183	125	156	141	126	111	177	150
1925	178	161	164	196	154	172	105	162	153
1926	122	172	267	178	108	154	109	126	143
1927	128	199	190	130	122	137	101	132	121
1928	150	192	119	128	138	129	89	175	159
1929	143	179	135	135	135	117	97	162	149
1930	100	124	179	132	120	92	95	122	140
1931	61	79	104	106	77	55	82	79	117
1932	47	101	62	65	43	44	63	45	102
1933	65	124	95	68	56	66	57	57	105
1934	97	164	98	90	95	91	89	121	104
1935	94	155	71	84	119	98	89	165	126
1936	94	165	143	97	118	109	75	147	113
1937	90	191	127	105	146	122	87	140	122
1938	67	165	80	88	76	75	63	98	101
1939	70	131	98	86	73	72	58	103	109
1940	78	145	102	97	91	84	64	126	121
1941	107	184	93	108	99	95	68	162	145
1942	149	272	158	124	123	116	84	206	199
1943	160	313	214	225	158	145	107	224	245
1944									
January	163	399	203	231	174	166	131	245	231
February	161	241	200	241	174	166	133	244	204
March	161	211	197	251	176	166	134	244	191
April	163	229	197	261	177	167	136	243	184
May	160	358	193	269	177	167	135	243	217
June	163	473	180	266	177	163	126	245	245
July	164	433	198	263	181	158	116	245	236
August	163	378	228	295	181	153	120	246	253
September	170	413	211	250	179	153	123	242	239
October	171	396	204	211	174	161	127	244	192
November	168	434	205	187	164	163	131	247	188
December	168	418	216	200	164	165	138	246	228

Wholesale Prices of Ammoniates

	Nitrate of soda per unit N bulk	Sulphate of ammonia bulk per unit N	Cottonseed meal S. E. Mills per unit N	Fish scrap, dried 11–12% ammonia, 15% bone phosphate, f.o.b. factory, bulk per unit N	Fish scrap, wet acidulated 6% ammonia, 3% bone phosphate, f.o.b. factory, bulk per unit N	Tankage 11% ammonia, 15% bone phosphate, f.o.b. Chicago, bulk, per unit N	High grade ground blood, 16–17% ammonia, Chicago, bulk, per unit N
1910–14	$2.68	$2.85	$3.50	$3.53	$3.05	$3.37	$3.52
1922	3.04	2.58	6.07	4.66	3.54	4.75	4.99
1923	3.02	2.90	6.19	4.83	4.25	4.59	5.16
1924	2.99	2.44	5.87	5.02	4.41	3.60	4.25
1925	3.11	2.47	5.41	5.34	4.71	3.97	4.75
1926	3.06	2.41	4.40	4.95	4.15	4.36	4.90
1927	3.01	2.26	5.07	5.87	4.35	4.32	5.70
1928	2.67	2.30	7.06	6.63	5.28	4.92	6.00
1929	2.57	2.04	5.64	5.00	4.69	4.61	5.72
1930	2.47	1.81	4.78	4.96	4.15	3.79	4.58
1931	2.34	1.46	3.10	3.95	3.33	2.11	2.46
1932	1.87	1.04	2.18	2.18	1.82	1.21	1.36
1933	1.52	1.12	2.95	2.86	2.58	2.06	2.46
1934	1.52	1.20	4.46	3.15	2.84	2.67	3.27
1935	1.47	1.15	4.59	3.10	2.65	3.06	3.65
1936	1.53	1.23	4.17	3.42	2.67	3.58	4.25
1937	1.63	1.32	4.91	4.66	3.65	4.04	4.80
1938	1.69	1.38	3.69	3.76	3.17	3.15	3.53
1939	1.69	1.35	4.02	4.41	3.12	3.87	3.90
1940	1.69	1.36	4.64	4.36	3.35	3.33	3.39
1941	1.69	1.41	5.50	5.32	3.27	3.76	4.43
1942	1.74	1.41	6.11	5.77	3.34	5.04	6.76
1943	1.75	1.42	6.30	5.77	3.34	4.86	6.62
1944							
January	1.75	1.42	7.40	5.77	3.34	4.86	6.71
February	1.75	1.42	7.40	5.77	3.34	4.86	6.71
March	1.75	1.42	7.40	5.77	3.34	4.86	6.71
April	1.75	1.42	7.50	5.77	3.34	4.86	6.71
May	1.75	1.42	7.81	5.77	3.34	4.86	6.71
June	1.75	1.42	7.81	5.77	3.34	4.86	6.71
July	1.75	1.42	7.81	5.77	3.34	4.86	6.71
August	1.75	1.42	7.81	5.77	3.34	4.86	6.71
September	1.75	1.42	7.81	5.77	3.34	4.86	6.71
October	1.75	1.42	7.81	5.77	3.34	4.86	6.71
November	1.75	1.42	7.81	5.77	3.34	4.86	6.71
December	1.75	1.42	7.81	5.77	3.34	4.86	6.71
Index Numbers (1910-14 = 100)							
1922	113	90	173	132	117	140	142
1923	112	102	177	137	140	136	147
1924	111	86	168	142	145	107	121
1925	115	87	155	151	155	117	135
1926	113	84	126	140	136	129	139
1927	112	79	145	166	143	128	162
1928	100	81	202	188	173	146	170
1929	96	72	161	142	154	137	162
1930	92	64	137	141	136	12	130
1931	88	51	89	112	109	63	70
1932	71	36	62	62	60	36	39
1933	59	39	84	81	85	97	71
1934	59	42	127	89	93	79	93
1935	57	40	131	88	87	91	104
1936	59	43	119	97	89	106	121
1937	61	46	140	132	120	120	122
1938	63	48	105	106	104	93	100
1939	63	47	115	125	102	115	111
1940	63	48	133	124	110	99	96
1941	63	49	157	151	107	112	126
1942	65	49	175	163	110	150	192
1943	65	50	180	163	110	144	189
1944							
January	65	50	211	163	110	144	191
February	65	50	211	163	110	144	191
March	65	50	211	163	110	144	191
April	65	50	214	163	110	144	191
May	65	50	223	163	110	144	191
June	65	50	223	163	110	144	191
July	65	50	223	163	110	144	191
August	65	50	223	163	110	144	191
September	65	50	223	163	110	144	191
October	65	50	223	163	110	144	191
November	65	50	223	163	110	144	191
December	65	50	223	163	110	144	191

Wholesale Prices of Phosphates and Potash**

	Superphosphate Baltimore, per unit	Florida land pebble 68% f.o.b. mines, bulk, per ton	Tennessee phosphate rock, 75% f.o.b. mines, bulk, per ton	Muriate of potash bulk, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash in bags, per unit, c.i.f. Atlantic and Gulf ports	Sulphate of potash magnesia, per ton, c.i.f. Atlantic and Gulf ports	Manure salts bulk, per unit, c.i.f. Atlantic and Gulf ports[1]	Kainit, 20% bulk, per unit, c.i.f. Atlantic and Gulf ports
1910–14	$0.536	$3.61	$4.88	$0.714	$0.953	$24.18	$0.657	$0.655
1922	.566	3.12	6.90	.632	.904	23.87	....	.508
1923	.550	3.08	7.50	.588	.836	23.32	....	.474
1924	.502	2.31	6.60	.582	.860	23.72	....	.472
1925	.600	2.44	6.16	.584	.860	23.72	....	.483
1926	.598	3.20	5.57	.596	.854	23.58	.537	.524
1927	.535	3.09	5.50	.646	.924	25.55	.586	.581
1928	.580	3.12	5.50	.669	.957	26.46	.607	.602
1929	.609	3.18	5.50	.672	.962	26.59	.610	.605
1930	.542	3.18	5.50	.681	.973	26.92	.618	.612
1931	.485	3.18	5.50	.681	.973	26.92	.618	.612
1932	.458	3.18	5.50	.681	.963	26.90	.618	.591
1933	.434	3.11	5.50	.662	.864	25.10	.601	.565
1934	.487	3.14	5.67	.486	.751	22.49	.483	.471
1935	.492	3.30	5.69	.415	.684	21.44	.444	.488
1936	.476	1.85	5.50	.464	.708	22.94	.505	.560
1937	.510	1.85	5.50	.508	.757	24.70	.556	.607
1938	.492	1.85	5.50	.523	.774	25.17	.572	.623
1939	.478	1.90	5.50	.521	.751	24.52	.570	.670
1940	.516	1.90	5.50	.517	.730	24.75	.573	....
1941	.547	1.94	5.64	.522	.780	25.55	.570	....
1942	.600	2.13	6.29	.522	.810	25.74	.205	....
1943	.631	2.00	5.93	.522	.786	25.35	.195	....
1944								
January	.640	2.00	6.10	.535	.797	26.00	.200	....
February	.640	2.00	6.10	.535	.797	26.00	.200	....
March	.640	2.00	6.10	.535	.797	26.00	.200	....
April	.640	2.00	6.10	.535	.797	26.00	.200	....
May	.640	2.00	6.10	.535	.797	26.00	.200	....
June	.640	2.00	6.10	.471	.701	22.88	.176	....
July	.646	2.16	6.10	.503	.749	24.44	.188	....
August	.650	2.20	6.10	.503	.749	24.44	.188	....
September	.650	2.20	6.10	.503	.749	24.44	.188	....
October	.650	2.20	6.10	.535	.797	26.00	.200	....
November	.650	2.20	6.10	.535	.797	26.00	.200	....
December	.650	2.20	6.10	.535	.797	26.00	.200	....
Index Numbers (1910-14 = 100)								
1922	106	87	141	89	95	99	....	78
1923	103	85	154	82	88	96	....	72
1924	94	64	135	82	90	98	....	72
1925	110	68	126	82	90	98	....	74
1926	112	88	114	83	90	98	82	80
1927	100	86	113	90	97	106	89	89
1928	108	86	113	94	100	109	92	92
1929	114	88	113	94	101	110	93	92
1930	101	88	113	95	102	111	94	93
1931	90	88	113	95	102	111	94	93
1932	85	88	113	95	101	111	94	90
1933	81	86	113	93	91	104	91	86
1934	91	87	110	68	79	93	74	72
1935	92	91	117	58	72	89	68	75
1936	89	51	113	65	74	95	77	85
1937	95	51	113	71	79	102	85	93
1938	92	51	113	73	81	104	87	95
1939	89	53	113	73	79	101	87	93
1940	96	53	113	72	77	102	87	....
1941	102	54	110	73	82	106	87	....
1942	112	59	129	73	85	106	84	....
1943	117	55	121	73	82	105	83	....
1944								
January	119	55	125	75	84	108	83	....
February	119	55	125	75	84	108	83	....
March	119	55	125	75	84	108	83	....
April	119	55	125	75	84	108	83	....
May	119	55	125	75	84	108	83	....
June	119	55	125	66	74	95	80	....
July	121	60	125	70	79	101	82	....
August	121	61	125	70	79	101	82	....
September	121	61	125	70	79	101	82	....
October	121	61	125	75	84	108	83	....
November	121	61	125	75	84	108	83	....
December	121	61	125	75	84	108	83	....

Combined Index Numbers of Prices of Fertilizer Materials, Farm Products and All Commodities

	Farm prices*	Prices paid by farmers for commodities bought*	Wholesale prices of all commodities†	Fertilizer materials‡	Chemical ammoniates	Organic ammoniates	Superphosphate	Potash
1922.....	132	149	141	116	101	145	106	85
1923.....	143	152	147	114	107	144	103	79
1924.....	143	152	143	103	97	125	94	79
1925.....	156	156	151	112	100	131	109	80
1926.....	146	155	146	119	94	135	112	86
1927.....	142	153	139	116	89	150	100	94
1928.....	151	155	141	121	87	177	108	97
1929.....	149	154	139	114	79	146	114	97
1930.....	128	146	126	105	72	131	101	99
1931.....	90	126	107	83	62	83	90	99
1932.....	68	108	95	71	46	48	85	99
1933.....	72	108	96	70	45	71	81	95
1934.....	90	122	109	72	47	90	91	72
1935.....	109	125	117	70	45	97	92	63
1936.....	114	124	118	73	47	107	89	69
1937.....	122	131	126	81	50	129	95	75
1938.....	97	123	115	78	52	101	92	77
1939.....	95	121	112	79	51	119	89	77
1940.....	100	122	115	80	52	114	96	77
1941.....	124	131	127	86	56	130	102	77
1942.....	159	152	144	93	57	161	112	77
1943.....	192	167	150	94	57	160	117	77
1944								
January...	196	174	150	96	57	171	119	78
February..	195	175	151	96	57	171	119	78
March.....	196	175	151	96	57	171	119	78
April.....	196	175	152	96	57	172	119	78
May.....	194	175	152	97	57	175	119	78
June.....	193	176	151	95	57	175	119	69
July.....	192	176	152	96	57	175	121	74
August....	193	176	151	96	57	175	121	74
September.	192	176	151	96	57	175	121	74
October...	194	176	152	97	57	175	121	78
November.	196	177	152	97	57	175	121	78
December..	200	178	152	97	57	175	121	78

* U. S. D. A. figures.

† Department of Labor index converted to 1910-14 base.

‡ The Index numbers of prices of fertilizer materials are based on original study made by the Department of Agricultural Economics and Farm Management, Cornell University, Ithaca, New York. These indexes are complete since 1897. The series was revised and reweighted as of March 1940 and November 1942.

[1] Beginning with June 1941, manure salts prices are F. O. B. mines, the only basis now quoted.

**** The annual average of potash prices is higher than the weighted average of prices actually paid because since 1926 better than 90% of the potash used in agriculture has been contracted for during the discount period. From 1937 on, the maximum seasonal discount has been 12%.**

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizer

"Fertilization of Farm Fish Ponds," Ext. Serv., Ala. Polytechnic Inst., Auburn, Ala., Cir. 270, Jan. 1944, Allen M. Pearson.

"Barnyard Manure—Its Value and Use in Alaska," Matanuska Exp. Sta., Palmer, Alaska, Cir. 2, April 1944, Don L. Irwin.

"Consolidated Figures for 1943 Showing Equivalent Plant Foods Supplied by Each Mixed Fertilizer Grade Used in California," Dept. of Agr., Bu. of Chemistry, Sacramento 14, Calif., FM-98, Nov. 22, 1944.

"Ammonium Phosphate and Similar Fertilizers. Dept. of Agr., Bu. of Chemistry, Sacramento 14, Calif., FM-99, Nov. 20, 1944.

"Amounts of Plant Foods Used on Various Crops in California During January-June 1943," Dept. of Agr., Bu. of Chemistry, FM-100, Nov. 20, 1944.

"The Uptake of Nutrients by the Cotton Plant When Fertilized with Acid Forming and Non-Acid Forming Fertilizers Combined with Different Rates of Potash," Ga. Exp. Sta., Experiment, Ga., Bul. 235, Sept. 1944, J. J. Skinner, J. G. Futral, and N. McKaig, Jr.

"Commercial Fertilizers in Kentucky in 1943," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., Reg. Ser. Bul. 38, July 1944.

"Fertilizers for Kentucky, 1944-45," Agr. Exp. Sta., Univ. of Ky., Lexington, Ky., A. Mim. 128, July 1944, P. E. Karraker.

"Ordinary and Deep Applications of Fertilizer for Corn, 1942-43," Agr. Exp. Sta., Miss. State College, State College, Miss., Service Sheet 375, June 1944, John Pitner.

"Soil Fertility Practices for Cotton Production: Heathman Field," Agr. Exp. Sta., Miss. State College, State College, Miss., Service Sheet 376, July 1944, John Pitner.

"Commercial Fertilizers for Cotton Production: Gary Field, Money, Miss.," Agr. Exp. Sta., Miss. State College, State College, Miss., Service Sheet 277, July 1944, John Pitner.

"Fertilizers for 1945 Recommended by the N. Y. State College of Agriculture," Dept. of Agron., College of Agr., Cornell Univ., Ithaca, N. Y., Mimeo 758, Oct. 24, 1944.

"Analyses and Rates of Application of Fertilizer for Vegetable Crops, Potatoes and Fruit in N. Y. 1945," Dept. of Agron., College of Agr., Cornell Univ., Ithaca, N. Y., Mimeo 761, Nov. 27, 1944.

"Fertilizer Report," Pa. Dept. of Agr., Harrisburg, Pa., G. Bul. 596, Oct. 1944.

"Fertilizer Test with Irish Potatoes in 1943," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 881, Feb. 29, 1944, W. L. Jones, Jr.

"Relation of Pure Chemical Fertilizers to Minor Element Requirements of Certain Field Soils Under Intensive Cropping," Va. Polytechnic Inst., Blacksburg, Va., B.37(11), Sept. 1944, F. L. Wellborn, M. M. Phillippe, and S. S. Obenshain.

"Fertilizer Tonnage Sales Survey Report for Washington for July 1, 1942 to June 30, 1943," Agr. Exp. Sta., State College of Wash., Pullman, Wash., M. Cir. 17, Sept. 1944, S. C. Vandecaveye.

"Tests of Four Nitrogen-Carriers in a Mature Apple Orchard at Martinsburg, West Virginia," Agr. Exp. Sta., W. Va. Univ., Morgantown, W. Va., Bul. 315, July 1944, R. H. Sudds.

"1944 Results of Fertilizer Demonstrations on Small Grain and Hay," Soils Dept., Univ. of Wis., Madison, Wis., Nov. 1944, C. J. Chapman.

Soils

¶ A rather complete chemical study of some Hawaiian soils has been made by A. S. Ayres and reported in Hawaii Agricultural Experiment Station Technical Bulletin No. 1 entitled "Soils of High-Rainfall Areas in the Hawaiian Islands." Most of the soils on the Island are of volcanic origin, but of widely different ages. Hawaiian lavas are usually low in silica, with quartz almost entirely lacking. They are also low in potassium, but high in iron, titanium, calcium, and magnesium. Most of the soils are rather heavy in texture and are considered to be in the lateritic group, although some evidences of podzolization have been observed. The soils

studied by the author were in the Coastal region of two of the Islands and are used principally for growing sugarcane.

In the examination of the soils, exchangeable and total bases were determined individually and as a group, with some studies on acidity and organic matter.

Exchangeable calcium varied from very low to rather high amounts. There was a rather close relationship between the exchangeable calcium in the soil and the rainfall of the area in which the soil was found, the higher the rainfall the lower the amount of exchangeable calcium present in the surface soil. Even though the exchangeable calcium is frequently low, in general there is not much response to liming. A possible explanation for this is the excellent physical condition of Hawaiian soils and the long growing period of the sugarcane crop, thus permitting it to obtain what calcium it needs even in soils of low available calcium content. Some soils were very low in total as well as exchangeable calcium, and this occurred even in soils from areas of rather low rainfall. The calcium apparently weathers out of Hawaiian soils very rapidly, since the unweathered rock is usually rather high in calcium.

Exchangeable magnesium in the soils also varied considerably and usually was lower than exchangeable calcium. Here again, there was a relationship between rainfall and exchangeable magnesium in the surface soil. It is felt that farming practices are tending to deplete the magnesium. Total magnesium varied considerably in the soil, but apparently is not always lost by weathering to the same extent as calcium, due possibly to a tendency of magnesium to form secondary minerals on weathering.

The author brings out that both sugarcane and pineapples have exceptionally high requirements for potash which, combined with the naturally low potash content of the soils, has resulted on many of the plantations in rather heavy fertilization with this nutrient. The exchangeable potash content of the soils varied widely, but in many cases it was higher in the surface soil than in the subsoil—the reverse of the cases of calcium and magnesium, indicating some relative accumulation of potash in the surface soils as the result of fertilization. This is further substantiated by the fact that in a subsurface horizon, many of the soils contained higher levels of exchangeable potassium than of exchangeable calcium or magnesium, a condition not found in any of the virgin soils studied. The relative distribution of exchangeable potassium in the surface soil and subsoil is influenced by rainfall. Regions of low rainfall have relatively much more exchangeable potassium in the surface soils which drops rapidly until the increasing rainfall reaches about 125 inches annually. Above this, the exchangeable potash in the surface soil is less than in the subsoil and continues to decrease as rainfall increases. Total potassium was not determined in the soils under investigation.

Exchangeable manganese varied rather widely with amounts ranging from less than 4 to more than 50 lbs. MnO per acre-foot of soil. Cultivation does not seem to have influenced the supplies of exchangeable manganese in soils. Manganese contents of both surface soils and subsoils varied widely, and comparatively low proportions of total manganese were present in the exchangeable form. Total base exchange capacities of the soil varied from 33 to 60 milliequivalents per hundred grams of soil. The base exchange capacity was reduced as rainfall increased, apparently due largely to the decrease in mineral exchange capacity in these soils of higher rainfall and to the increased carbon-nitrogen ratio resulting in the organic matter having a lower exchange capacity. These factors more than offset the normal increase in exchange capacity due to increased total organic-matter content of these wetter soils. Base exchange saturation also was lower with the higher rainfall. The soils were acid, the surface soils more

so than the subsoils, due apparently to the high organic-matter content.

¶ Thomas Jefferson is known to all of us as the writer of the Declaration of Independence and as one of our greatest Presidents. Many of us are apt to neglect the agricultural side of his life, since it was overshadowed by his more spectacular activities in political fields. Thomas Jefferson, however, had a deep interest in agriculture and an understanding of the fundamental problems connected with it far in advance of most other agriculturists of his day. Many of these interesting and significant facts have been brought to light by Dr. H. H. Bennett and published in U. S. Department of Agriculture Soil Conservation Service Miscellaneous Publication No. 548 entitled "Thomas Jefferson, Soil Conservationist." It is fitting that Dr. Bennett, Chief of the Soil Conservation Service and one of the outstanding men of the world in this field of activity, has written on this subject. This brief but interesting pamphlet shows what remarkable powers of investigation and foresight Jefferson had in the field of agriculture. He recommended crop rotations, the careful conservation and use of manure, and the use of fertilizer in the limited forms available in his day. Even more remarkable, perhaps, is the fact that he was much concerned with conserving soils and preventing erosion, recommending many of the practices that today the Soil Conservation Service is advocating. This includes contour farming, the use of leguminous cover-crops, and terracing. Dr. Bennett has written a stimulating as well as interesting pamphlet on Jefferson and his relationship to modern agriculture.

"Soil Reaction (pH)," Agr. Exp. Sta., Univ. of Fla., Gainesville, Fla., Bul. 400, Aug. 1944, G. M. Volk and C. E. Bell.

"Soil Movement as Affected by Slope, Discharge, Depth, and Velocity of Water," Agr. Exp. Sta., State College, Raleigh, N. C., T. Bul. 78, Jan. 1944.

"Improvement of Flood-Damaged Land in Eastern Oklahoma," Agr. Exp. Sta., A. & M. College, Stillwater, Okla., Bul. 282, Oct. 1944, Horace J. Harper.

"48 Ways to Save the Soil While Increasing Production," Ext. Serv., A. & M. College, Stillwater, Okla., OP-67, 1944.

"The Soil Conservation Service in Pennsylvania," U.S.D.A., Harrisburg, Pa., May 1944.

"Progress in Determination of Conservation-Farming Needs," U.S.D.A., Washington, D. C., June 1944.

"List of Publications and Reports on Sedimentation—Jan. 1, 1935 to Aug. 1, 1944," Soil Conserv. Serv., U.S.D.A., Washington, D. C., Aug. 1, 1944.

Crops

¶ Peanuts have always been an important crop in certain localities of the South and under the requirements of our war-food program have come into increased prominence. War-food goals have called for greatly increased acreages, with the result that many farmers, who had no previous experience with it, grew the crop during the last year or two. The results were not always happy from both the national food production viewpoint and the farmer's own viewpoint. To assist growers already growing the crop and to enable others to judge whether or not they should venture into this new field of production, many experiment stations have issued publications dealing with peanut growing. An excellent example is Virginia Agricultural Experiment Station Bulletin 348 entitled "Peanut Production" by E. T. Batten. This deals primarily with the type of production prevailing in Virginia and will be a great inducement to growers in that State. It will also be helpful to growers in the northern peanut-growing sections.

The author traces the production of peanuts from pre-Civil War days and briefly describes the various types of peanuts and their uses. It is brought out clearly that the soil is very important in determing whether or not peanuts should be grown, since good drainage is of paramount importance for this crop. The fertilization of the crop is given prominent attention. Where the entire crop is harvested, peanuts remove nitrogen and large quantities of mineral elements from the soil. This occurs when peanuts are dug since the vines are usually used for hay. If peanuts

are grown in a rotation with other legumes, nitrogen in the fertilizer usually is not required under Virginia conditions, but phosphoric acid and potash as well as lime are of great importance. The general recommendation is that 350 to 400 lbs. of 0-12-12 be applied either by means of an attachment to the planter which puts the fertilizer in bands along the row, or applied on top of the row just as the plants are emerging. Great care must be taken that no fertilizer comes in direct contact with the seed if the fertilizer is applied at planting time. The high-grade potash fertilizers are much better sources of potash than the lower grade materials since in the latter case there is a higher salt concentration which is unfavorable for peanuts.

Lime is usually required at 1,500 to 1,800 lbs. of ground limestone every 3 or 4 years in rotations where peanuts are grown. In areas where the Virginia type peanuts are grown, gypsum or land plaster is very commonly used. However, the author of this publication points out that at the Experiment Station, where lime is used in the rotation, gypsum did not increase yield. The author believes, however, that gypsum will be beneficial when used on soils that are acid and low in lime. Three hundred pounds of this material per acre usually are applied on the vines during the growing season, up to August 1. Mr. Batten also includes information on preparation of the land, planting, cultivation, harvesting, and insect and disease control.

"Fifty-Second Annual Report," Agr. Exp. Sta., Ala. Polytechnic Inst., Auburn, Ala., 1941.

"Small Grain Production," Ext. Serv., Ala. Polytechnic Inst., Auburn, Ala., Cir. 258, June, 1943, J. C. Lowery and D. G. Sturkie.

"Potatoes: Growing, Fertilizing, and Storing in Alaska," Matanuska Exp. Sta., Palmer, Alaska, Cir. 3, April 1944, Don L. Irwin.

"Progress Through Agricultural Research," Agr. Exp. Sta., A. & M. College, Baton Rouge, La., A. R. 1942-43.

"Experiments with Cotton, Corn, Sorghum, and Soybeans at the Rice Experiment Station, Crowley, La.," Agr. Exp. Sta., A. & M. College, Baton Rouge, La., Bul. 383, Aug. 1944, J. M. Jenkins.

"Results of Experiments with Rice in La.," Agr. Exp. Sta., A. & M. College, Baton Rouge, La., Bul. 384, Aug. 1944, J. M. Jenkins and J. W. Jones.

"Studies of Delayed Digging of Sweet Potatoes of the Porto Rico Variety," Agr. Exp. Sta., A. & M. College, Baton Rouge, La., Cir. 34, Sept. 1944, W. D. Kimbrough.

"Annual Report," Me. Exp. Serv., Univ. of Me., Orono, Me., Bul. 325, Nov. 1944.

"Small Grain Varieties, Hill Soils, 1944," Agr. Exp. Sta., Miss. State College, State College, Miss., Inf. Sheet 319, Aug. 1944, J. F. O'Kelly.

"Dates of Planting Soybeans: Stoneville, 1943," Agr. Exp. Sta., Miss. State College, State College, Miss., Service Sheet 374, May 1944, R. B. Carr.

"Varieties of Winter Wheat for Nebraska," Agr. Exp. Sta., Univ. of Neb., Lincoln, Neb., Bul. 367, Aug. 1944, K. S. Quisenberry, O. J. Webster, and T. A. Kiesselbach.

"Plant Diseases in Texas and Their Control," Ext. Serv., A. & M. College, College Station, Texas, B-132, May 1944, A. A. Dunlap and J. F. Rosborough.

"Wichita Wheat," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 891, May 11, 1944, I. M. Atkins, J. R. Quinby, and P. B. Dunkle.

"Experiments with Small Grain and Other Crops at Substation No. 6, Denton," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 892, May 11, 1944, P. B. Dunkle and I. M. Atkins.

"Clipping Experiments with Small Grain Varieties, 1943-44, at Substation No. 19, Winter Haven, Texas," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 901, Aug. 1, 1944, E. Mortensen.

"Variety and Date of Planting of Small Grain for Grazing and for Grain in South Texas," Agr. Exp. Sta., A. & M. College, College Station, Texas, P. R. 903, Aug. 21, 1944, R. A. Hall and Lucas Reyes.

"Extension Work in Agriculture and Home Economics in 1943," Ext. Serv., Va. Polytechnic Inst., Blacksburg, Va., Bul. 160, March 1944, John R. Hutcheson.

"24th Annual Report of Wood County Agricultural Extension Service, 1944," Agr. Ext. Serv., Wisconsin Rapids, Wis., H. R. Lathrope.

Economics

¶ One of the problems of Southern agriculture is often attributed to the system of land tenure whereby a considerable portion of the land is operated by tenants or share croppers rather than owners. It is also felt that an owner, since he has a proprietary interest in the land and has a greater assurance of continuity of tenure, will

farm better, especially from the long-time viewpoint, and eventually should be a more efficient farmer. Interesting information on this has been obtained in a survey conducted in Georgia for the year 1936. The results of this work were published as Georgia Experiment Station Bulletin 234, "A Study of Farming by Tenure of Farms in Terrell County, Georgia," by W. T. Fullilove, J. C. Elrod, and W. E. Hendrix.

In most cases, the data are broken down on the basis of owners who are operating the farms themselves, owners with share croppers operating the farms, tenants operating the farms themselves, and tenants with share croppers operating the land. As might be expected, owners with share croppers have larger farms than the other groups. Tenants tended to have smaller farms. Farms without croppers, that is, operated by those on them, either as owners or as tenants, are smaller than farms operated by croppers. Apparently, croppers preferred working on larger farms than on smaller farms, since they were able to have advantages of better equipment and possibly better land.

In the area, cotton and Spanish peanuts are the two principal crops grown for cash, with corn the main feed crop. Owners tended to grow more cotton and less peanuts than did tenants. This is partly explained on the basis of labor conditions and is considered of some significance, since peanuts are harder on land than cotton. Farms operated by owners with croppers had higher yields than farms operated with owners alone or those operated by tenants, although tenants had a higher yield index than did owners who farmed the land themselves. Expenditures for fertilizers were higher on owner-operated than on tenant-operated farms, and on owner-operated farms with croppers than on farms without croppers.

Other investigations indicated that erosion was worse on tenant-operated farms than on owner-operated farms. In this survey, it was found that both groups had about the same proportion of the land devoted to soil-depleting crops, but owner-operated farms had a higher proportion of land planted to conserving crops than did tenant-operated farms. Tenants apparently believed just as strongly as owners in the use of soil-conserving crops. Unstable tenure was not given as a reason for the tenants' failure to grow more soil-conserving crops, but the authors feel that this is the biggest factor involved. The size of farms seems to be an important factor in determining the amount of livestock. Tenants compared favorably with owners in livestock kept per unit of land. In general, however, operators with share-croppers had much lower livestock values per unit of land than did operators without share croppers.

On the basis of income, tenants compared rather favorably with owners operating the land themselves, after due allowance was made for rent and interest on assessment. Croppers sometimes do better than owner operators, after such allowances are made.

The authors admit that many of the factors involved in tenancy were not measured, and are difficult to measure in dollars and cents. These involve disruption in home and school life caused by frequent moving by tenants, and a lowered community interest and efficiency resulting thereby. They feel that tenants should have greater security of tenure and be given credit for long-time improvements made on farms they are operating. Many other interesting and useful points are brought out in this investigation, which is important from the sociological as well as the economic viewpoint.

"Postwar Program for Idaho Agriculture, Ranges, and Forests," Agr. Exp. Sta., Univ. of Idaho, Moscow, Idaho, Cir. 91, Aug. 1944.

"The Cost of Producing Hemp in Illinois in 1943," Agr. Exp. Sta., College of Agr., Urbana, Ill., AE-2198, May 1944, R. H. Wilcox.

"Production Adjustments in Louisiana's Agriculture for 1945," Ext. Serv., Baton Rouge 3, La., D.A.E. Mimeo. Cir. 44, July 25, 1944.

"Financial Results of the Operation of large Sugar Cane Farms in Louisiana 1939, 1940, and 1941," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 374, March 1944, R. A. Ballinger.

"Increasing the Market Outlets for Louisiana Winter Vegetables Through Mixed Shipments," Agr. Exp. Sta., La. State Univ., Baton Rouge, La., Bul. 382, Aug. 1944, P. T. Ecton.

"Postwar Agricultural Prospects," Agr. Exp. Sta., Univ. of Minn., St. Paul, Minn.

"Economic and Cost Study of Cotton Ginning in Central Mississippi," Agr. Exp. Sta., Miss. State College, State College, Miss., Bul. 403, June 1944, D. G. Miley and A. L. Roberts.

"Economics of the Production and Marketing of Chile in New Mexico," Agr. Exp. Sta., State College, N. M. Bul. 314, April 1944, P. W. Cockerill.

"Attaining Maximum Agricultural Production in Ohio in 1945," Agr. Exp. Sta., Ohio State Univ., Columbus, Ohio, July 1944.

"Land Utilization and Agricultural Adjustment in Edgefield County, S. C.," Agr. Exp. Sta., Clemson Agr. College, Clemson, S. C., Bul. 349, June 1944, M. J. Peterson and G. H. Aull.

"The Impact of the War on the Financial Structure of Agriculture," Bu. of Agr. Econ., U.S.D.A., Washington, D. C., A. S. Tostlebe, D. C. Horton, R. J. Burroughs, H. C. Larsen, L. A. Jones, and A. R. Johnson.

"Farmers' Cooperatives and the Federal Income Tax Statutes," Farm Cr. Adm., U. S. D. A., Washington, D. C., Misc. Report 75, Oct. 1944, K. B. Gardner.

"The Impact of the War on the Financial Structure of Agriculture," U. S. D. A., Washington, D. C., Sept. 1944, A. S. Tostlebe, D. C. Horton, P. J. Burroughs, H. C. Larsen, L. A. Jones, and A. R. Johnson.

Fertilizers for Cotton and Corn Following Lespedeza

(*From page* 19)

TABLE 4.—COTTON FOLLOWING LESPEDEZA. HIGHLAND RIM SOIL PROVINCE.

Fertilizer treatment per acre	Pounds of seed cotton per acre	Average of five tests. Increase due to treatment
None	488	.....
300 lbs. 0–16–0	716	228
300 lbs. 0–16–16	1,072	584
300 lbs. 0–16–16 plus minor elements	1,040	552
300 lbs. 6–16–16 plus minor elements	1,024	536

yield over the check plot by 228 pounds of seed cotton per acre. When 300 pounds of 0-16-16 were used, the yield increased 584 pounds per acre. The addition of nitrogen, or nitrogen and minor elements, to the phosphate and potash did not increase the yield.

Two cooperative tests were conducted with corn on the Highland Rim province and two in the Coosa Valley on old lespedeza areas (Table 5). An application of superphosphate produced an increased yield of 6.4 bushels of corn. Superphosphate and muriate of potash resulted in increasing the yield 11.1 bushels. As in the tests with cotton, the yield of corn was not increased by adding minor elements or minor elements and nitrogen to the phosphate and potash.

The data from these tests are not conclusive, but they strongly indicate that on the soils studied there is a very great need of phosphate and potash for both cotton and corn when these crops are planted after lespedeza. An

TABLE 5.—CORN FOLLOWING LESPEDEZA

Fertilizer treatment per acre	Bushels of corn per acre	Average of four tests. Increase due to treatment
None	21.9	.....
300 lbs. 0–16–0	28.3	6.4
300 lbs. 0–16–16	33.0	11.1
300 lbs. 0–16–16 plus minor elements	33.0	11.1
300 lbs. 6–16–16 plus minor elements	33.5	11.6

increase was obtained from minor elements in only one test. Most of the results obtained up to the present indicate that lespedeza will furnish sufficient nitrogen to produce a good crop of cotton or corn, provided sufficient phosphate and potash are added. Unless the proper kind and amount of fertilizers are applied to the cotton or corn, there will be little or no increase in yield as a result of turning lespedeza for soil improvement.

As a result of these experiments, the Alabama Experiment Station recommends that cotton and corn following lespedeza should be fertilized at planting with a minimum of 400 pounds of 0-14-10, or 275 to 300 pounds of superphosphate and 75 to 100 pounds of muriate of potash per acre.

Bigger Yields from Fertilizers

(*From page* 26)

we probably will find that we can expect to get economic returns from more fertilizer if we can find a means of distributing it more generally in the soil.

In experiments in which we have compared plowed-under fertilizer with row methods, including the shallow band and side-dressing methods, year in and year out over a period of years, the average yields have been greater where the fertilizer was plowed under. Placing it in the bottom of the plowed furrow or in the subsoil has been consistently as good or better.

It seems reasonable that when we have our soils in condition where we can be assured of a broad distribution of roots in the subsoil, we will find that we can increase our yields by using greater amounts of fertilizer. However, we may find that our 1-2-1 or 1-2-2 ratios may have to be changed to a 1-1-1 or 2-1-2 or others, depending on the crops to be grown. In other words, we may approach more closely the ratios of salts which the plants actually remove from the soil. However, until we get to the point where we recognize the importance of soil reaction (as affecting root distribution), soil type, rainfall and other climatic factors in studying fertilizer-placement problems, we may be a long time in coming to any agreement. A method that is suitable for the application of 500 lbs. of fertilizer probably will not prove suitable for the application of 2,000 lbs. Agronomic crops require smaller quantities of fertilizers than vegetable crops. Wide row crops may benefit by different methods of application from narrow rowed crops, or those sown broadcast.

There is considerable discussion about shallow- and deep-rooted vegetable plants which always comes up in a discussion of fertilizer placement and is confusing. Root systems differ in size, but when we come to classify them as deep- and shallow-rooted, we don't seem to talk the same language. Several years ago, Mr. Bateman and I looked over a 34-acre potato field in which the nitrogen seemed to have leached away. As we walked along between the rows, it was apparent that every fourth or fifth plant was normal while those between were definitely bronzy in appearance and were considerably smaller. In looking crosswise of the rows, the good plants lined up in rows. The immediate conclusion was that we had an example of the effect of residual fertilizer, but the previous year the field had been in rye and the year before that in corn, and the rows had run the same direc-

An attachment for applying fertilizer on the bottom of the plow furrow, designed by machinery manufacturer.

tion as the potato rows. However, the third year before, the field had been in tomatoes and the rows had run crosswise of the field coinciding with the good potato plants. A heavy application of superphosphate had been placed in the row for the tomatoes with a fertilizer attachment on a potato planter. Mr. Bateman got a spade and we examined the roots of the potato plants. The good plants had their roots down as deep as we dug, which was between 2½ and 3 feet, and they were brightly colored. The stunted plants had all their roots in the upper 8 inches of soil, and they were brown in color. The difference probably was due to the amount of oxygen in the soil. Poor drainage under the poor plants with high temperatures had injured the roots. The gypsum in the superphosphate for tomatoes undoubtedly had a beneficial effect in opening the subsoil to better drainage and aeration.

We have many soils on market garden farms in this condition, brought about by the continuous application of fertilizer to the surface coupled with insufficient liming material. Plowing under both fertilizer and lime on these soils is bringing them back. Crops like spinach, onions, and beets, which were shallow-rooted because of the soil condition, have become deep-rooted by the application of lime and fertilizer in the subsoil. It is not uncommon to find spinach seedlings with only the cotyledons expanded, to have a root system 22 inches straight down into the subsoil, which explains why spinach responds to fertilizer plowed under.

And so it seems reasonable to assume that in soil properly limed, plowing under the fertilizer will give better results over a period of years even though it may be beaten by some other method of application in an occasional year because of weather conditions. A method that has proven consistently better than plowing under fertilizer is the application of fertilizer in solution. Until we have machinery to apply liquids more economically, the broad distribution of fertilizer seems to give better results. Upon perfection of machinery, deeper and broader distribution of either liquid or dry fertilizer may prove to be a more economical method.

Fertilized Corn Plants Require Well-ventilated Soils

(*From page* 9)

HCl test solution (A) to each soil mass and fold paper back onto the treated soil.

3. Turn over the folded paper and test the wet under-side of the paper, at (a) with one drop of Solution B—(Ferric-iron test); and one drop Solution C—(Ferrous-iron test) at (b). Fig. 2.

The results must be recorded at once:

Fig. 3—A reddish to deep red color at (a) indicates ferric iron. This means an adequate oxygen supply in soil for corn roots.

Fig. 4—A bluish to deep blue color at (b) indicates ferrous iron. This indicates an oxygen deficiency for corn roots. If both ferric and ferrous iron tests are obtained, the oxygen deficiency is relatively less important.

Discussion of Tests

The importance of making the tests very quickly can be demonstrated by permitting additional soil samples to be exposed to the air, particularly in the sunlight, for several minutes and then repeating the tests. A negative ferric iron test soon becomes a positive one and shows the rapidity of the oxidation process in many soils.

Other interesting facts on oxygen penetration in soils can be noted by making tests for ferric iron in the channels formed by deep penetrating roots of previous crops of alfalfa, sweet clover, ragweed, and others. Also compare the depth of aeration over tile drains versus between tiles, if any, or between high and low areas in the field.

Always make comparative tests for ferric iron in the soil above and below the plow sole if a definite plow sole has developed in the soil. In some soils a hardpan often interferes with the oxygen penetration below it, and corn roots may be limited in growth above the hardpan. These tests will indicate the necessity for including deep-rooting alfalfa and sweet clover in a soil management program if the ferric iron tests are low below the plow sole.

Tests made during the growing season with ample rainfall will give much useful information on the drainage and aeration capacities of fields for corn production. In dry seasons, the oxygen supply may be adequate and water may then become the limiting factor for growth. These interrelationships of water, oxygen for root respiration, and the maintenance of a favorable environment for corn-root functioning in absorbing fertilizing materials must be given proper evaluation in diagnosing these soil conditions for cornplant growth and production.

Fertilizers Pay Their Way in Western Washington

(*From page* 22)

range of parent material, the soil fertility problems of the area are rather complex.

Today, as a result of the work of the experiment stations and trials by farmers and others in the area, much of the acreage of cultivated crops is fertilized with commercial materials. The ratio of NPK used varies with the soil and the kind and value of the crops, and the availability of planters and drills with proper fertilizer placement attachments. Certain crops, at this time, receive only one or two of the common fertilizer constituents. An example of this is oats, or other cereals

Potatoes respond well to fertilizers in western Washington. Harvest of White Rose potatoes grown on Puget sandy loam.

for hay, on upland soils. The greatest response is obtained from spring applications of nitrogen. In these instances, it is recommended that manure and other fertilizer be used in the rotation to aid in maintaining the fertility of the soil.

In the case of intensively cultivated crops, the rate application of a complete commercial fertilizer varies from 600 to 3,000 pounds per acre, depending on the value of the crop.

The production of potatoes for the certified seed trade and for commercial trade is an important enterprise in several of the counties of western Washington. Complete commercial fertilizers are profitably used in practically all plantings. The rate of application per acre appears to be increasing annually.

The data given in tables 1 and 2 indicate the response that is obtained from the use of varying amounts 10-20-20 fertilizer for potatoes.

The results of a few studies made by the Western Washington Experiment Station with indication of the response obtained from the use of complete fertilizers on certain crops

TABLE 1.—YIELD IN POUNDS PER ACRE OF WHITE ROSE POTATOES ON PUGET SANDY LOAM, ARLINGTON, FERTILIZED WITH VARYING AMOUNTS OF 10-20-20 FERTILIZER

Lbs. per A. 10–20–20	Check	250	500	750	1,000
No. 1 grade	9,483	11,500	14,466	14,191	15,649
Increase over check pounds per acre		2,017	4,983	4,708	6,166
Culls	2,699	3,233	3,549	4,399	2,908
Increase over check pounds per acre		534	850	1,700	209
Total No. 1 and Culls	12,182	14,732	18,015	18,590	18,557
Increase over check pounds per acre		2,550	5,833	6,408	6,375
Value of increase above cost of fertilizer		$13.92	$37.33	$27.33	$36.66

TABLE 2.—YIELD IN POUNDS PER ACRE NETTED GEM POTATOES—HERB ECKSTRAN FARM, MOUNT VERNON, PUGET SILT LOAM, FERTILIZED WITH VARYING AMOUNTS OF 10-20-20 FERTILIZER

Lbs. per A. 10–20–20	Check	250	500	750	1,000	1,500
No. 1 grade	13,280	17,650	19,800	20,800	24,850	19,100
Increase over check pounds per acre	.....	4,370	6,520	7,520	11,570	5,820
Culls	16,800	14,850	17,550	15,100	17,225	17,000
Increase over check pounds per acre	.....	−1,950	750	−1,700	425	200
Total yields No. 1's and culls	30,080	32,500	39,150	35,900	42,075	36,100
Increase over check pounds per acre	.....	2,420	9,070	5,820	11,995	6,020
Percent No. 1 grade	44.0	54.3	55.0	57.8	59.0	52.9
Value of increase above cost of fertilizer	.....	$37.45	$52.70	$56.45	$90.70	$20.70

are given in Table 3. The yields are given in pounds per acre. This list could be greatly enlarged upon, but it indicates the results that have been obtained from the use of complete commercial fertilizers.

Peas for canning, and particularly for freezing, are grown extensively and respond well to the use of fertilizers. Because of the lack of suitable machinery to properly place mixtures containing nitrogen and potash, phosphorus is used almost exclusively for this crop. Potash fertilizers when used are pre-drilled before peas are seeded. The increase in yield varies from 200 to 1,000 pounds of cleaned peas per acre from an application of 300 pounds of 18 per cent superphosphate per acre.

Growth of sweet clover on limed strips on the Joe Donnely Farm, Chambers Prairie. No growth on unlimed areas in foreground.

TABLE 3.—RESPONSE OF CERTAIN CROPS TO USE OF COMPLETE FERTILIZERS

Crop	Check No. Fertilizer	Fertilized	Fertilizer used per acre	Value of crop per lb. in cents	Value of increase above cost of fert.
Canning beets..	30,690	39,325	600 5–15–10	$0.01	$71.35
Spinach seed...	1,277	1,787	600 5–15–10	.20	87.00
Beet seed (red)..	1,400	1,900	600 5–15–10	.30	135.00
Spinach.....	3,390	8,126	400 10–20–20	.02	78.72
Swiss chard....	45,520	65,980	400 10–20–20	.015	290.90
Carrots.....	74,284	82,787	600 5–15–10	.01	70.03
Sweet corn.....	10,878	15,186	500 5–20–10	.015	49.62

5–15–10 at $50.00 per ton
10–20–20 at $80.00 per ton
5–20–10 at $60.00 per ton

The response obtained from the use of potash varies with the crop and the soil on which it is grown. Potash deficiency symptoms have been observed on a number of crops, particularly where vegetables are grown for the first time in certain areas. Applications of from 60 to 90 pounds of K_2O in mixed fertilizers are usually sufficient to meet the needs of most vegetable crops under average soil conditions. There are, of course, numerous exceptions to this. For potatoes, celery, cabbage, and certain other crops, the application is increased to 120 to 160 pounds of K_2O per acre.

The use of lime is becoming more prevalent, and it is necessary for the efficient production of legumes and certain other crops on a number of soils. In general, the soils that require heavy liming also require heavy application of NPK for maximum yields.

Good soil management, which includes the use of green manure crops, farm manures, and soil amendments when necessary, the increased use of supplemental irrigation, a gradual intensification of the agriculture of the area, the development of better mechanical fertilizer applicators, all point toward an even greater consumption of commercial fertilizers in western Washington in the years ahead.

Better Rural Churches Through Wise Land Use

(*From page* 16)

Soil conservation, obviously, cannot solve all of the ills of the rural church and agriculture. It's real objective, however, is to use soil resources safely in such a way that they will produce the best returns for the farmer and society. If the farmer benefits, then the church and society, too, will benefit.

The status of the rural church, especially those churches located in areas where erosion is a serious problem, can be improved by religious leaders and farmers working closely together and developing a better understanding of their mutual problems. A step in this direction has been taken by the leaders of the Upper South Carolina Methodist Conference, in which the study of 222 rural churches was made. They have launched a training program for their pastors so that the latter can work more efficiently in encouraging and helping farmers to make better use of their land. Slides and other visual material depict-

ing local erosion conditions and land misuse and the results of remedial conservation measures are used in the training work.

Another encouraging sign is that during recent years religious leaders in the Southeast have become deeply concerned with the erosion problem. At the rural life conference held last year at Columbia, Mississippi, which attracted a large number of the South's leading religious and agricultural workers, one of the principal objectives of the conference was "to enable farmers to recognize their obligations as stewards of the soil." This phrase, "stewards of the soil," is expressive of a sound attitude toward the land. Further recognition of the need for this kind of an attitude toward the land was given at this year's statewide rural life conference conducted by Governor Thomas L. Bailey on April 17 and 18 at Jackson, Mississippi. More than 1,800 religious and agricultural leaders attended this conference during which they had an opportunity to participate in the impressive church service dedicated to the seed, the soil, and the sowers. This dedicatory service was developed by the Rev. James W. Sells, Methodist pastor of Crystal Springs, Mississippi, and is now being used by a large number of Southern churches of various denominations.

After directing the rural life conference at Jackson, Mississippi, Governor Bailey participated in the quadrennial conference of the Methodist Church at Kansas City and introduced a resolution which said in part:

"Human welfare depends upon the proper use of the soil and other natural resources. Accordingly we call upon our people to recognize their responsibility to God for the conservation, the development, and the right use of the total resources of a rural community."

The resolution was adopted unanimously.

Another encouraging trend is the increasing attention being given soil conservation at the special summer schools or training institutes held for pastors. At 20 such meetings held by various denominations in the South this year, proper land use and its relation to the church were studied, and the same subjects are scheduled for consideration at a number of other pastors' schools yet to be held.

Ministerial associations also are lending their support, as is being strikingly demonstrated by the Ministerial Association of Anderson County, South Carolina. A pageant, "The Giant of the Wastelands," portraying erosion as an invisible, destructive enemy of mankind, but which can be subdued through proper soil conservation methods, is being presented this year in the Anderson County churches. It was prepared by the Rev. J. H. Carter, pastor of the Central Presbyterian Church of Anderson.

Once church officials as well as farmers and others understand and pledge themselves to a genuine stewardship of the soil, and follow through with constructive action, the rural church will receive new strength and be in a much better position to serve society.

Renunciation

(*From page* 5)

confidence in pursuit of my cigarettes to know that the person pushing me in the back is a member of the Ladies' Aid. But as the famous song runs, "It's about as fur as they can go," because I doubt if many women will lug reeking pipes with them in their reticules or tackle old Tiger with the toothsome relish of bygone days.

There is at least one item to fall back

upon to ease the craving for tobacco, but it's not apt to catch hold fast. I refer to those small pill boxes containing "Copenhagen" that some of my Scandinavian friends have clung to with avidity. In early times, snuff boxes were proof of lineage and high aristocracy, but in America as I knew it most of the snooze has been snuffed by Swedes and back-country tribesmen among the hills. The main reason for so little snuff-taking in the northern States seems to be that our hard winters produce so many head colds that we get our sneezing naturally without paying good money for irritated membranes.

When it comes to home-made cigarettes, most folks will ditch nicotine before they fuss around with sleazy wrappers and loose tobacco. Verily, the machine age has put all of the handicraft artisans into the limbo of the lost.

One might proceed further and peddle some of the pet grievances on hand among us home-folks concerning other big "deprivations" such as butter, gasoline, and shotgun shells. Lest you think I intend to avoid pointing any morals in my customary manner, this is a fine place to desist and digress.

THIS is the time to dwell upon some other substitutes and makeshifts which many of us have been using consciously or unconsciously in our efforts to keep firm hold of what we call the status quo or normalcy in American living.

Wishful thinking is one of our famous substitutes used for lighting our pipe dreams and greasing our gears. Failure to face the facts may at times be due to our inability to get them related to us in a forthright way. Too often we have relied upon some blatant columnist or radio commentator to keep us supplied with the kind of stuff we want to hear and believe, without stopping to think that he may be just as much in the dark as we are about the big secret moves going on amid power politicians and hoss-traders behind the scenes.

Somebody said lately that what we need most is an efficient "intelligence department," and that is a mouthful. What we don't require right now is more "advertising and selling" philosophy, because we have been oversold to the hilt on much bellywash and buncombe concerning sacred causes and the invincible nature of our wartime preparations.

WE have been preached at countless times over our so-called provincialism and our isolated ideas and habits of looking at world affairs. Then right in the middle of such sermonizing, we find some of our chief spokesmen in high spots minus their shirts and unwilling to take a firm stand on anything overseas which squares up with the cause to which our vast efforts have been dedicated.

Sometimes I think our dear public's frame of mind has too often been as bad as those foolish congressmen and their friends who packed picnic baskets and drove out to Bull Run in July 1861, to watch the New York Zouaves and New England volunteers lick the pants off of Beauregard. Only it did not quite turn out to be a picnic and the people learned from this grim lesson that the war was doomed to last four years more with more pains than picnics.

Wishful thinking is no substitute for sober judgment and calm renunciation of many things we regarded as necessary to any adequate comfort and happiness on the hearthstone. If we dally around and short-circuit our energies hunting for a few chance packets of Smellerinos or grouching because our B-gas coupons are too few, it looks to me like a big split between those of us who are behaving like patriots and those who act like punks.

Speaking of punks, some farm "leaders" out in our western neck of the big woods got heated up and inflamed over the recent national vote derby. It did not go just as their wishful thinking had invoked. These fellows had been

going pretty strong as solicitors in the current war bond campaigns. When the Sixth Loan Drive started, they refused to move a peg among their neighbors, but tax time was not the reason given. What they really said was that bond selling hereafter must be left to the New Dealers and the big shots of the AAA. The result was that some rural areas fell short of their quotas in spite of three-dollar milk, and the rest bought their bonds at the nearest banks.

WHEN I hear that kind of remote control thinking, I fetch out the book wherein the loving kindness and fortitude of the womenfolks during the Civil War is related—both sides having plenty of it to spare.

Of course, I know one side better than the other, and hence to mention Mother Bickerdyke of Galesburg, Illinois, will do just as nicely as to hold up some kind war nurse in Dixie. What she told the Milwaukee Chamber of Commerce boys in a supposed speech of "thanks" for money gifts to help pay for field hospital service is very timely right now. And by the way, she never stopped to see whether a wounded kid wore blue or gray before heating up the soup kettle.

It seems that Milwaukee financiers had pledged about twelve hundred smackers a month and the headquarters at Chicago sent Mother Bickerdyke up there to express gratitude, only she did not do it in the expected way.

Substantially, her words were thus: "I am glad to see you give us this money and we can make good use of it. But it isn't any more than you should do and probably not as much as you might do. For instance, if you had your choice would you pay a thousand dollars or lose your left leg, or fifteen hundred or your right arm, or two thousand or both legs, or three thousand or your eyes, or maybe all you've got or your life? Yet I've got four thousand boys in Chattanooga who have lost their legs and arms and eyesight and health without boasting they have done a lot for their country. And over behind the hospital we have a big graveyard where hundreds more gave everything they ever had and no questions asked.

"I suggest that it is a good time to quit telling what we have given and what we have sacrificed and what we have done without—as long as we haven't done a darn thing compared to those boys in my hospital."

That's why Mother Bickerdyke was asked to ride the big horse ahead of the band when the Army of the Tennessee marched across the Potomac in the grand review of 1865. I doubt if some of our doughty verbose henchmen, full of wishful thinking and narrow prejudice, will ride any horses in posts of honor in coming hours of triumph.

Yes, I guess we are in for a spell of renunciation all right, and it won't be on New Year's only. Too many times we catch our zestful postwar planners laying schemes for immediate resumption of normal pull-hauling and bickering here in America, acting just as ornery and cantankerous as the empire builders we deride so freely.

IF we are going to ask some other country with big postwar ambitions to lay aside its dreams of conquest and be reasonable, then maybe we should trim our sails here and lay off some of this high-advertising pressure in behalf of privileged groups and industrial blocs.

Some of my advisers think it may be wise to legislate stiffly against some of the special privilege and selfishness at home and abroad, adding teeth enough to bite violations. If that is done soon enough, it may turn out like my cigarettes and gasoline, and be a fine time for renouncing something which you can't get if you want it.

Finally, this all adds up to the crumb of comfort given to me as a kid when teacher explained a punishment by saying, "This helps to maintain your discipline, and well-disciplined people are the best liked folks in the world."

FOR NEW MOTHERS

When giving the baby a bath, a thermometer is unnecessary. If the baby turns red, the water is too hot. If the baby turns blue, the water is too cold; if the baby turns white, you will know he needed the bath.

"I hear you and the leading lady are on the outs."

Electrician: "Yeah, it was one of those quick change scenes with the stage all dark. She asked for her tights and I thought she said lights."

TOO MUCH

Two American soldiers in Egypt lived for months on dehydrated butter and vegetables. Visiting a Cairo museum they saw their first mummy. "This is going too far," said one. "Now they're dehydrating women!"

"Remember when Dorothy Lamour came out on the stage in her sarong—how quiet it was?"

"Yeah. You could hear the sailors waiting for a pin to drop."

Professor—"What is your idea of civilization?"

Sophomore—"I think it's a very good idea. Somebody ought to start it."

Dentist: "Young man, what kind of a filling do you want in your tooth?"

Boy: "Chocolate."

EFFICIENCY EXPLAINED

"Perkins, Parkins, Peekham, and Potts—good morning."

"I want to speak to Mr. Perkins."

"Who's calling, please?"

"Mr. Pincham of Pincham, Pettam, Poppum and Pogg."

"Just a moment, please. I'll connect you with Mr. Perkins' office."

"Hello, Mr. Perkins' office."

"I want to speak to Mr. Perkins."

"Mr. Perkins? I'll see if he is in. Who's calling, please?"

"Mr. Pincham."

"Just one moment, Mr. Pincham. Here's Mr. Perkins. Put Mr. Pincham on, please."

"Just one moment, please, I have Mr. Pincham right here. Okay with Perkins, Parkins, Peekham and Potts, Mr. Pincham. Go ahead."

"Lo, Jo? How's about lunch?"

"Okay."

Polly: "I'm going to have that famous young doctor examine me."

Molly: "But why? You're perfect everywhere?"

Polly: "Yes, that's what I want him to find out."

"Teacher makes us raise a hand,"
Said little Donald Root.
"But Fido hasn't any hands,
So he has to raise a foot."

Little Girl: "Papa, what makes a man always give a woman a diamond engagement ring?"

Papa: "The woman."

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Authorities have recognized that the depletion of Boron in soil has been reflected in limited production and poor quality of numerous field and fruit crops.

Outstanding results have been obtained with the application of Borax in specific quantities or as part of the regular fertilizer mix, improving the quality and increasing the production of alfalfa and other legumes, table beets, sugar beets, apples, etc.

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Asparagus (General)
Vine Crops (General)
Sweet Potatoes (General)
Fertilize Potatoes for Quality and Profits (Pacific Coast)
Fertilizing Small Fruits (Pacific Coast)
Better Corn (Midwest) and (Northeast)
Fertilize Pastures for Better Livestock (Pacific Coast)
Of Course I'm Interested (Pastures, Canada)
Meet the Family (Canada)

Reprints

T-8 A Balanced Fertilizer for Bright Tobacco
N-9 Problems of Feeding Cigarleaf Tobacco
T-9 Fertilizing Potatoes in New England
F-3-40 When Fertilizing, Consider Plant-food Content of Crops
J-4-40 Potash Helps Cotton Resist Wilt, Rust, and Drought
S-5-40 What Is the Matter with Your Soil?
K-4-41 The Nutrition of Muck Crops
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FF-11-42 Boron in Agriculture
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M-3-43 Lespedeza Is Not A Poor Land Crop
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G-2-44 The Use of Borax in the Legume-Livestock Program of the South
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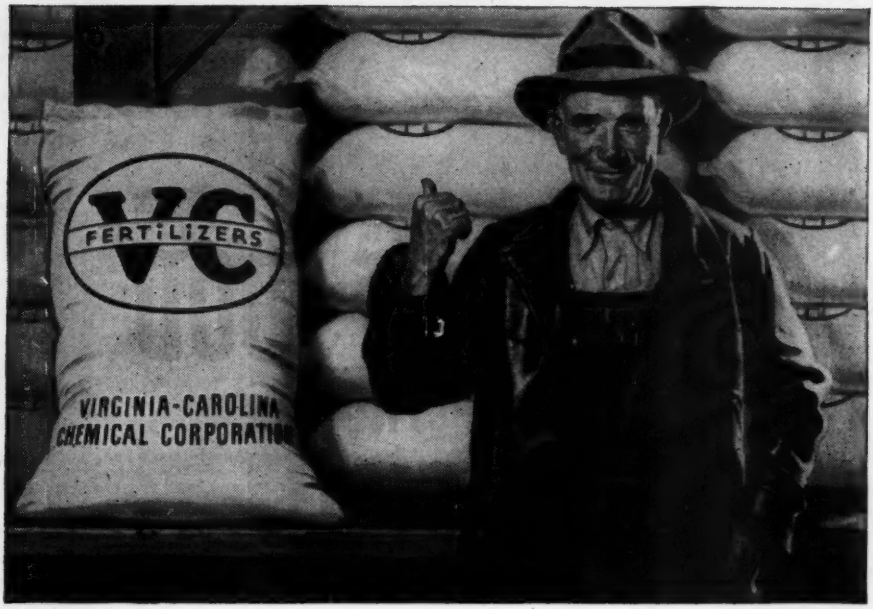

IN TIME to be ON TIME

THIS FARMER is ready to grow Victory Crops. He has bought all of his 1945 fertilizers. They are stored on his farm under shelter in a dry place. When he is ready to plant his seed, he will have his fertilizers on hand.

Farmers who delay too long in placing their orders may find themselves waiting for fertilizer at planting time. Under war conditions, the fertilizer industry simply cannot get a lot of extra labor and a lot of extra freight cars and trucks to fill a lot of last-minute orders. Too many late orders may result in a serious fertilizer shortage.

Fertilizers must start to move to farms early this month and continue to move steadily throughout the season. This is the only way the greatest fertilizer demand in history can be supplied, with a war shortage of labor and transportation.

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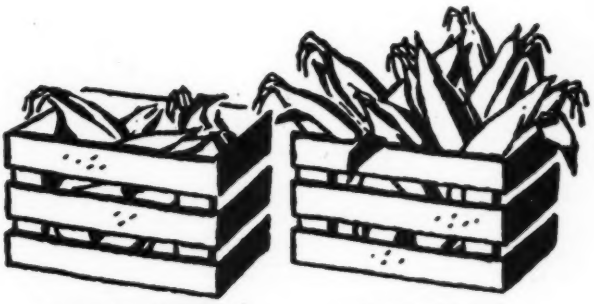

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